

MEAN VELOCITY, TURBULENCE INTENSITY AND
TURBULENCE CONVECTION VELOCITY
MEASUREMENTS FOR A CONVERGENT
NOZZLE IN A FREE JET WIND TUNNEL

COMPREHENSIVE DATA REPORT

PWA-5516

Prepared for
NASA Lewis Research Center
Under Contract NAS3-17866



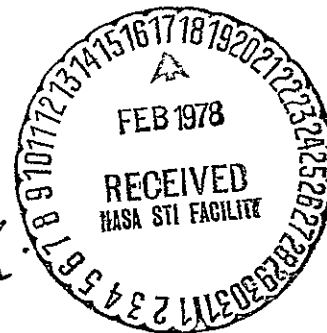
April 1977

Prepared by: C. J. McColgan
R. S. Larson

Approved by:

H. Kozlowski

H. Kozlowski
Program Manager



PRATT & WHITNEY AIRCRAFT GROUP

Commercial Products Division



**UNITED
TECHNOLOGIES.**

EAST HARTFORD, CONNECTICUT

(NASA-CR-135238) MEAN VELOCITY, TURBULENCE
INTENSITY AND TURBULENCE CONVECTION VELOCITY
MEASUREMENTS FOR A CONVERGENT NOZZLE IN A
FREE JET WIND TUNNEL. COMPREHENSIVE DATA
REPORT (Pratt and Whitney Aircraft) 262 p

N78-17991

HC A12/MF A01

Unclas

G3/02 04204

1 Report No CR-135238		2 Government Accession No		3 Recipient's Catalog No	
4 Title and Subtitle Mean Velocity, Turbulence Intensity and Turbulence Convection Velocity Measurements for a Convergent Nozzle in a Free Jet Wind Tunnel-Comprehensive Data Report				5 Report Date Dec., 1977	
				6 Performing Organization Code	
7 Author(s) C. J. McColgan R. S. Larson				8 Performing Organization Report No FWA-5516	
9 Performing Organization Name and Address Commercial Products Division Pratt & Whitney Aircraft Group United Technologies Corporation East Hartford, CT. 06108				10 Work Unit No.	
				11. Contract or Grant No NAS3-17866	
12 Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20546				13 Type of Report and Period Covered Contractor Report	
				14 Sponsoring Agency Code	
15 Supplementary Notes Project Manager, Orlando A. Gutierrez, VSTOL and Noise Division, NASA Lewis Research Center, Cleveland, Ohio					
16 Abstract The effect of flight on the mean flow and turbulence properties of a 0.056m circular jet were determined in a free jet wind tunnel. The nozzle exit velocity was 122 m/sec, and the wind tunnel velocity was set at 0, 12, 37, and 61 m/sec. Measurements of flow properties including mean velocity, turbulence intensity and spectra, and eddy convection velocity were carried out using two linearized hot wire anemometers. This report contains the raw data as obtained from the Saicor Model SAI-42 Probability and Cross-Properties Analyzer and the Spectral Dynamics 301C Spectrum Analyzer and 302C Ensemble Averager. Graphical presentations of the data are also included. The final technical report, NASA CR-2949, includes a description of the test facilities, test hardware, along with significant test results and conclusions.					
17. Key Words (Suggested by Author(s)) Turbulence Measurements Free Jet Wind Tunnel Hot Wire Anemometers Eddy Convection Velocity			18 Distribution Statement Unclassified - unlimited STAR Category 02		
19 Security Classif (of this report) Unclassified		20 Security Classif (of this page) Unclassified		21. No. of Pages 258 ^s	
22. Price*					

* For sale by the National Technical Information Service, Springfield, Virginia 22151

FOREWORD

This report is a compilation of the turbulence and mean flow measurements obtained during Task VIII of Contract NAS3-17866.

The companion final report, NASA CR-2949, includes a description of the facilities used, the hot wire measurements, the significant test results and conclusions.

TABLE OF CONTENTS

	<u>Page</u>
Introduction	1
Test Matrix	3
Data Index	4
A Mean Velocity Profiles	A
B Turbulence Intensity Profiles	B
C Normalized Turbulence Spectra	C
D Auto and Cross Correlations	D
E Filtered Auto and Cross Correlations	E
F Normalized Cross Correlation Coefficients	F

ORIGINAL PAGE IS
OF POOR QUALITY

INTRODUCTION

The hot wire data measured during Task VIII of the program are presented in this volume in graphical form according to the requirements of the work plan. Hot wire measurements of local flow properties were made at each of the stations in Table 1. The hot wire measurements were divided into two categories according to whether a single probe or two probes were necessary to acquire the data. A single probe was used to measure mean velocity and turbulence intensity profiles, and its signal was analyzed to provide frequency spectra and autocorrelations for selected points in the shear layer. The signals from two probes were cross correlated for varying values of probe separation. The mean velocity, turbulence intensity, and turbulence spectra obtained from a single probe are contained in Sections A to C and the autocorrelations and two probe data are contained in Sections D to G. The specific contents of each section of this report are described below.

Section A

This section contains the mean velocity profiles plotted at constant tunnel velocity at the required axial locations.

Section B

This section contains the turbulence intensity profiles corresponding to the mean velocity profiles in Section A.

Section C

This section presents the turbulence spectra at the maximum turbulence region of the shear layer (i.e., the "center" of the jet shear layer).

Section D

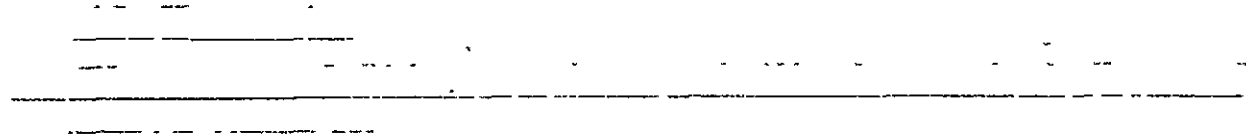
This section contains the auto and cross correlations at each axial station (see Table 1) with the various probe separations for the "inner," "center," and "outer" region of the jet shear layer.

Section E

This section contains the selected filtered auto and cross correlations.

Section F

This section presents the normalized corss correlation coefficients plotted versus the probe separation.



ORIGINAL PAGE IS
OF POOR QUALITY

TEST MATRIX

The convergent nozzle (2.23 in. dia.) was operated at a nominal exit velocity of 400 fps, while the tunnel velocity was set at 0, 40, 120 and 200 fps. The resulting values of the velocity ratio, m , defined as the wind tunnel velocity divided by the jet velocity, were 0, 0.1, 0.3 and 0.5. The various downstream measurement stations, normalized by the jet diameter, D , were selected for each velocity ratio as shown below:

TABLE 1

Downstream Measurement Stations

Velocity Ratio,	Axial Measurement Stations, X/D			
$m = \frac{U_e}{U_j}$				
0	3.0	5.0	-	
0.1	3.0	5.5	7.7	
0.3	3.0	6.8	9.5	
0.5	3.0	7.7	12.1	

DATA INDEX

The data presented in Sections A through F are arranged by the tunnel to jet velocity ratios, m . At the constant velocity ratio, data are presented in the ascending order of axial locations. For the two probe data, they are further arranged by the normalized radial locations, R/D , (i.e., the "inner," "center," and "outer" of the jet shear layer where R is measured from the jet centerline) and by the increasing probe separation.

The following index delineates the contents of the data compiled in this volume. The index is self-explanatory, listing the type of data, the tunnel to jet velocity ratios (m), axial locations (X/D), normalized radial locations (R/D), probe separations, and the page number.

A. Mean Velocity Profiles

m	$\frac{X}{D}$	Page
0	3.0, 5.0	A1
0.1	3.0, 5.5, 7.7	A2
0.3	3.0, 6.8, 9.5	A3
0.5	3.0, 7.7, 12.1	A4

B. Turbulence Intensity Profiles

m	$\frac{X}{D}$	Page
0	3.0, 5.0	B1
0.1	3.0, 5.5, 7.7	B2
0.3	3.0, 6.8, 9.5	B3
0.5	3.0, 7.7, 12.1	B4

ORIGINAL PAGE IS
OF POOR QUALITY

C. Normalized Turbulence Spectra (Max. Turbulence Region)

m	$\frac{X}{D}$	Page
0	3.0	C1
0	5.0	C2
0.1	3.0	C3
0.1	5.5	C4
0.1	7.7	C5
0.3	3.0	C6
0.3	6.8	C7
0.3	9.5	C8
0.5	3.0	C9
0.5	7.7	C10
0.5	12.1	C11

D. Auto and Cross Correlations

m	$\frac{X}{D}$	$\frac{R}{D}$	ΔX (in.)	Page
0	3.0	0.363	0.6	D1
	↓	↓	3.0	D4
			5.4	D6
			0.6	D8
	↓	↓	3.0	D10
			5.4	D12
			0.6	D14
			3.0	D16
	↓	↓	5.4	D18
			1.0	D20
			6.0	D22
			11.0	D24
	↓	↓	1.0	D26
			6.0	D28
			11.0	D30
			1.0	D32
0.1	↓	↓	6.0	D34
			11.0	D36
			0.5	D38
			3.0	D40
			5.5	D42
			0.5	D44
			3.0	D46
			5.5	D48
0.3	↓	↓	0.5	D50

m	$\frac{X}{D}$	$\frac{R}{D}$	ΔX (in.)	Page
↓ 0.1 ↓	↓	↓	3.0	D52
	5.5	0.290	5.5	D54
	↓	↓	0.3	D56
	5.5	0.484	3.3	D58
	↓	↓	6.3	D60
	↓	↓	0.3	D62
	↓	↓	3.3	D64
	↓	↓	6.3	D66
	↓	0.700	0.3	D68
	↓	↓	3.3	D70
	7.7	↓	6.3	D72
	↓	-0.006	0.5	D74
	↓	↓	3.0	D76
	↓	0.462	5.5	D78
	↓	↓	0.5	D80
	↓	↓	3.0	D82
	↓	0.782	5.5	D84
	↓	↓	0.5	D86
↓ 0.3 ↓	↓ 3.0 ↓	↓	3.0	D88
		↓	5.5	D90
		0.410	0.3	D92
		↓	1.8	D94
		0.518	3.3	D96
		↓	0.3	D98
		↓	1.8	D100
		0.608	3.3	D102
↓ 0.3 ↓	↓ 6.8 ↓ 9.5 ↓	↓	0.3	D104
		↓	1.8	D106
		↓	3.3	D108
		0.352	0.3	D110
		↓	3.3	D112
		0.496	6.3	D114
		↓	0.3	D116
		↓	3.3	D118
		0.658	6.3	D120
		↓	0.3	D122
		↓	3.3	D124
		↓	6.3	D126
		-0.045	0.4	D128
		↓	4.4	D130
		0.450	8.4	D132
		↓	0.4	D134

ORIGINAL PAGE IS
OF POOR QUALITY.

m	$\frac{X}{D}$	$\frac{R}{D}$	ΔX (in.)	Page
↓	↓	↓ 0.518 ↓	4.4	D136
			8.4	D138
			0.4	D140
			4.4	D142
			8.4	D144
↓	↓	↓ 0.401 ↓ 0.518 ↓	0.2	D146
			1.2	D148
			2.2	D150
			0.2	D152
			1.2	D154
↓	↓	↓	2.2	D156
↓	↓	↓ 0.586 ↓ -0.101 ↓ 0.304 ↓ 0.489 ↓ -0.118 ↓ 0.287 ↓ 0.431 ↓	0.2	D158
			1.2	D160
			2.4	D162
			0.4	D164
			4.4	D167
			8.4	D170
			0.4	D172
			4.4	D174
			8.4	D176
			0.4	D178
			4.4	D180
			8.4	D182
			0.4	D184
			4.4	D186
			8.4	D188
			0.4	D190
			4.4	D192
			8.4	D194
			0.4	D196
			4.4	D198
			8.4	D200

E. Filtered Auto and Cross Correlations

m	$\frac{X}{D}$	$\frac{R}{D}$	ΔX (in.)	Filtered Frequency	Page
0.3	6.8	0.496	3.3	0.1 - 0.25 KHz	E1
↓	↓	↓	↓	0.25 - 0.63 KHz	E3
				0.63 - 1.60 KHz	E5
				1.60 - 4.00 KHz	E6

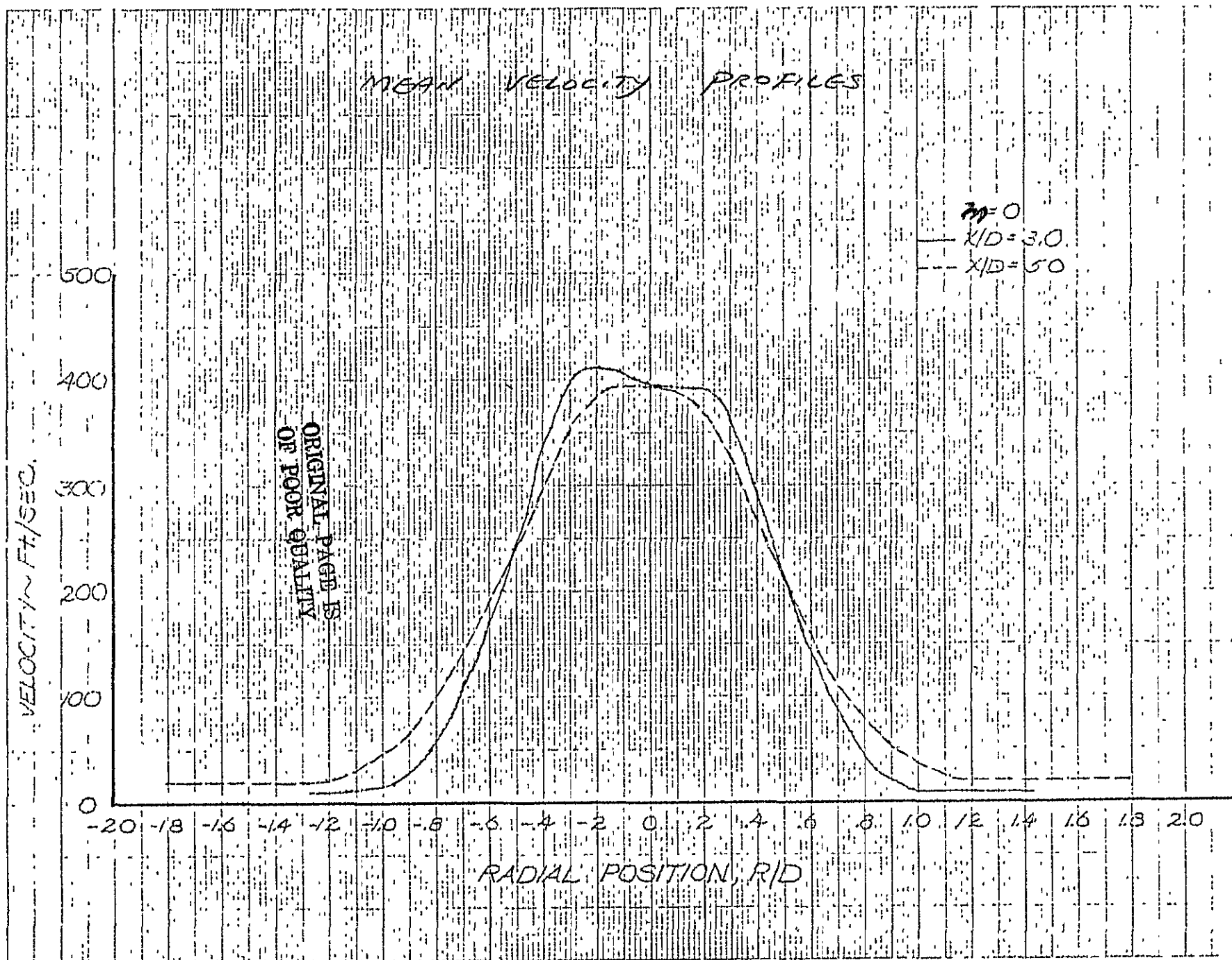
F. Normalized Cross Correlation Coefficients

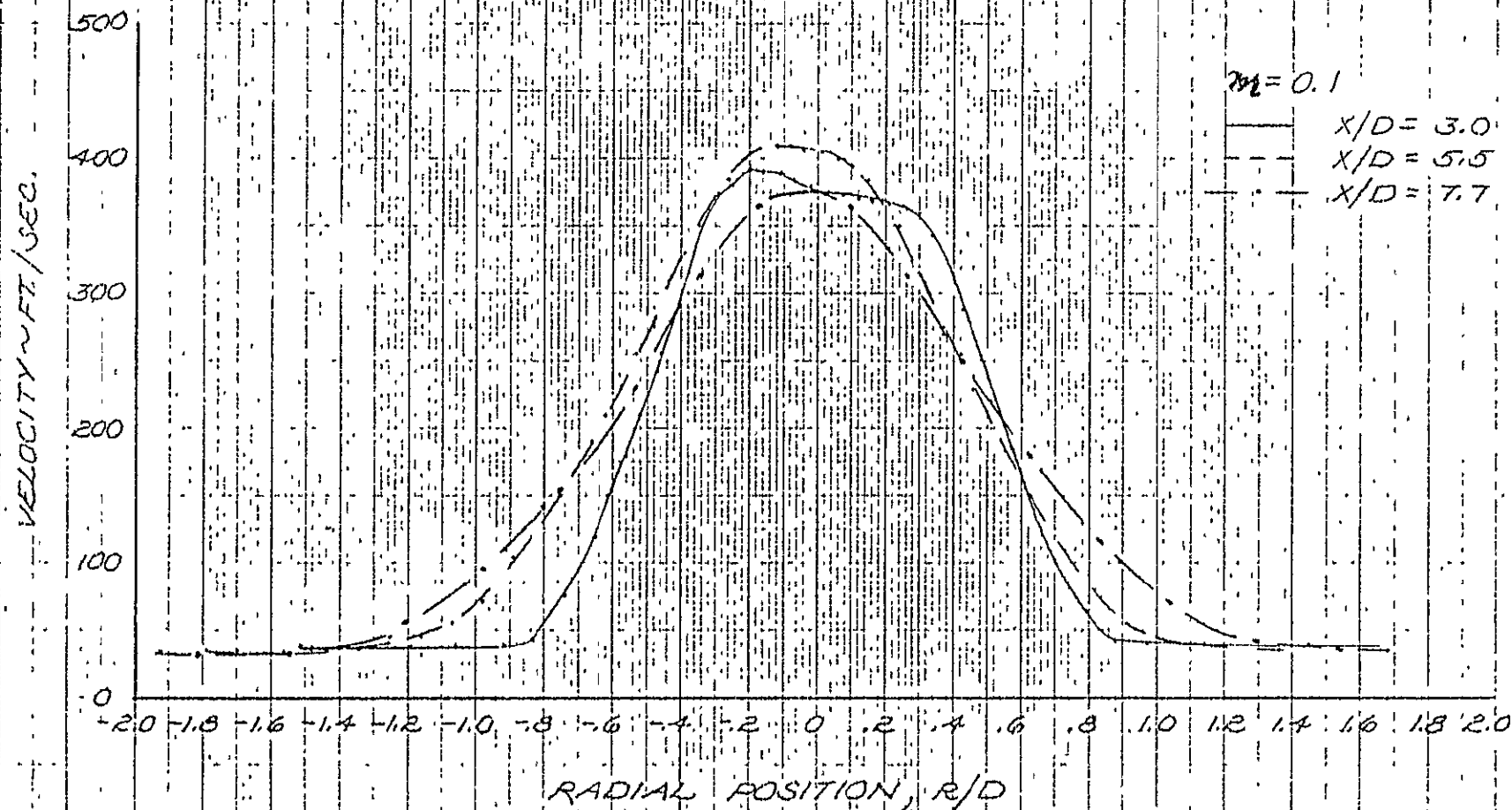
m	$\frac{X}{D}$	$\frac{R}{D}$	ΔX (in.)	Page
0	3.0	0.363, 0.507, 0.665	0.6, 3.0, 5.4	F2
0	5.0	0.304, 0.462, 0.665	1.0, 6.0, 11.0	F3
0.1	3.0	0.381, 0.471, 0.687	0.5, 3.0, 5.5	F4
0.1	5.5	0.290, 0.484, 0.700	0.3, 3.3, 6.3	F5
0.1	7.7	-0.006, 0.462, 0.782	0.5, 3.0, 5.5	F6
0.3	3.0	0.410, 0.518, 0.608	0.3, 1.8, 3.3	F7
0.3	6.8	0.352, 0.496, 0.658	0.3, 3.3, 6.3	F8
0.3	9.5	-0.045, 0.450, 0.518	0.4, 4.4, 8.4	F9
0.5	3.0	0.401, 0.518, 0.586	0.2, 1.2, 2.2	F10
0.5	7.7	-0.101, 0.304, 0.489	0.4, 4.4, 8.4	F11
0.5	12.1	-0.118, 0.287, 0.431	0.4, 4.4, 8.4	F12
0.3*	6.8	0.496	3.3	F13

*Filtered Frequency: 0.1 - 0.25 KHz
0.25- 0.63 KHz
0.63- 1.60 KHz
1.60- 4.00 KHz

A. Mean Velocity Profiles

The mean velocities were obtained from the mean voltage signals from the radial probe. The voltage signals were read from a digital DC voltmeter and a calibration curve was used to determine the mean velocity from the voltage output. Plots of mean velocity versus normalized radial position, R/D , are shown in Figures A1 through A4 for the various velocity ratios and axial locations.



$$x_2 = 0.1$$
$$X/D = 3.0$$
$$X/D = 5.5$$
$$X/D = 7.7$$


MEAN VELOCITY PROFILES

$M=0.3$
 $X/D=3.0$
 $X/D=6.8$
 $X/D=9.0$

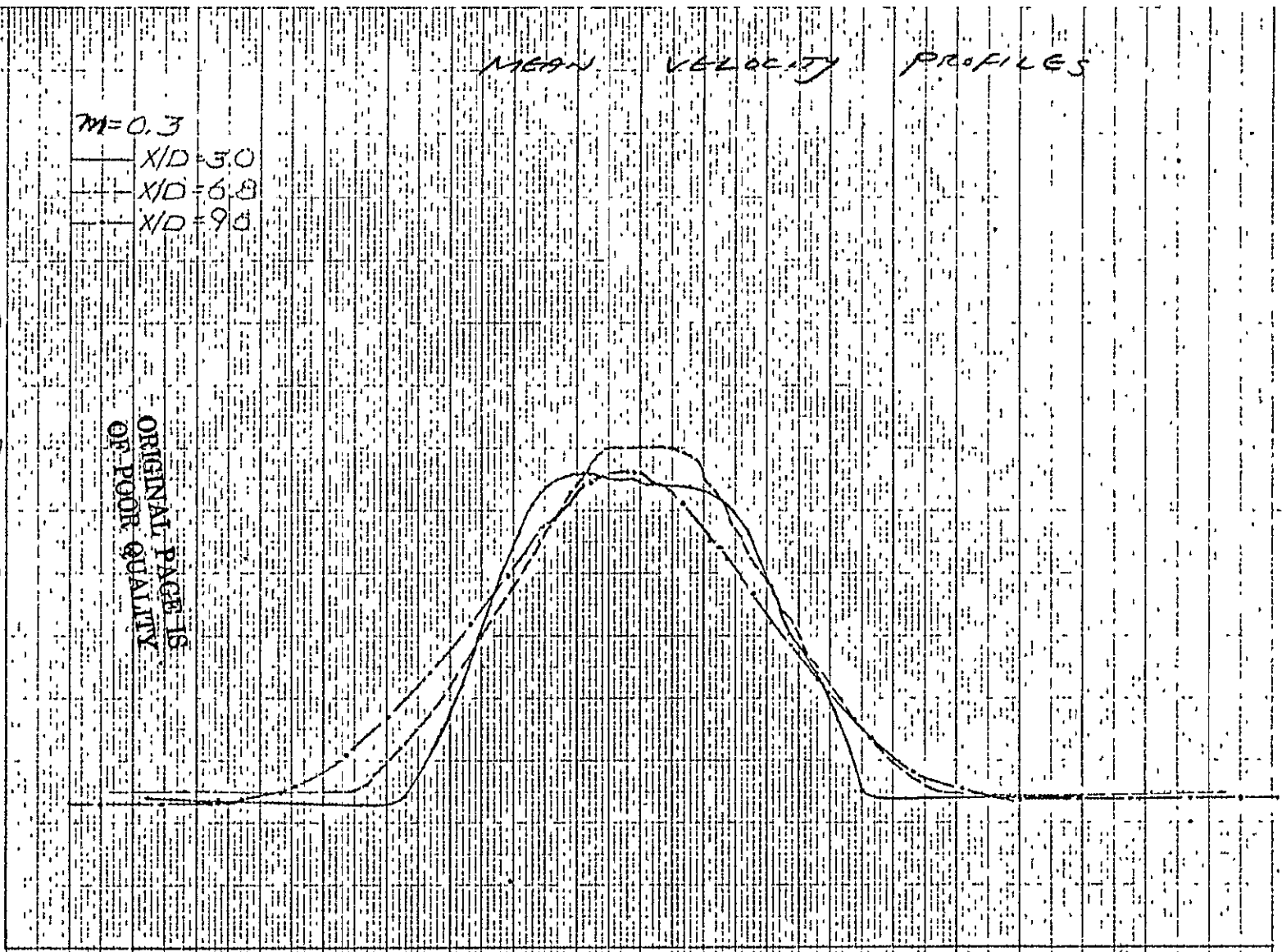
ORIGINAL PAGE IS
 OF POOR QUALITY

003/4 ~ 11007A

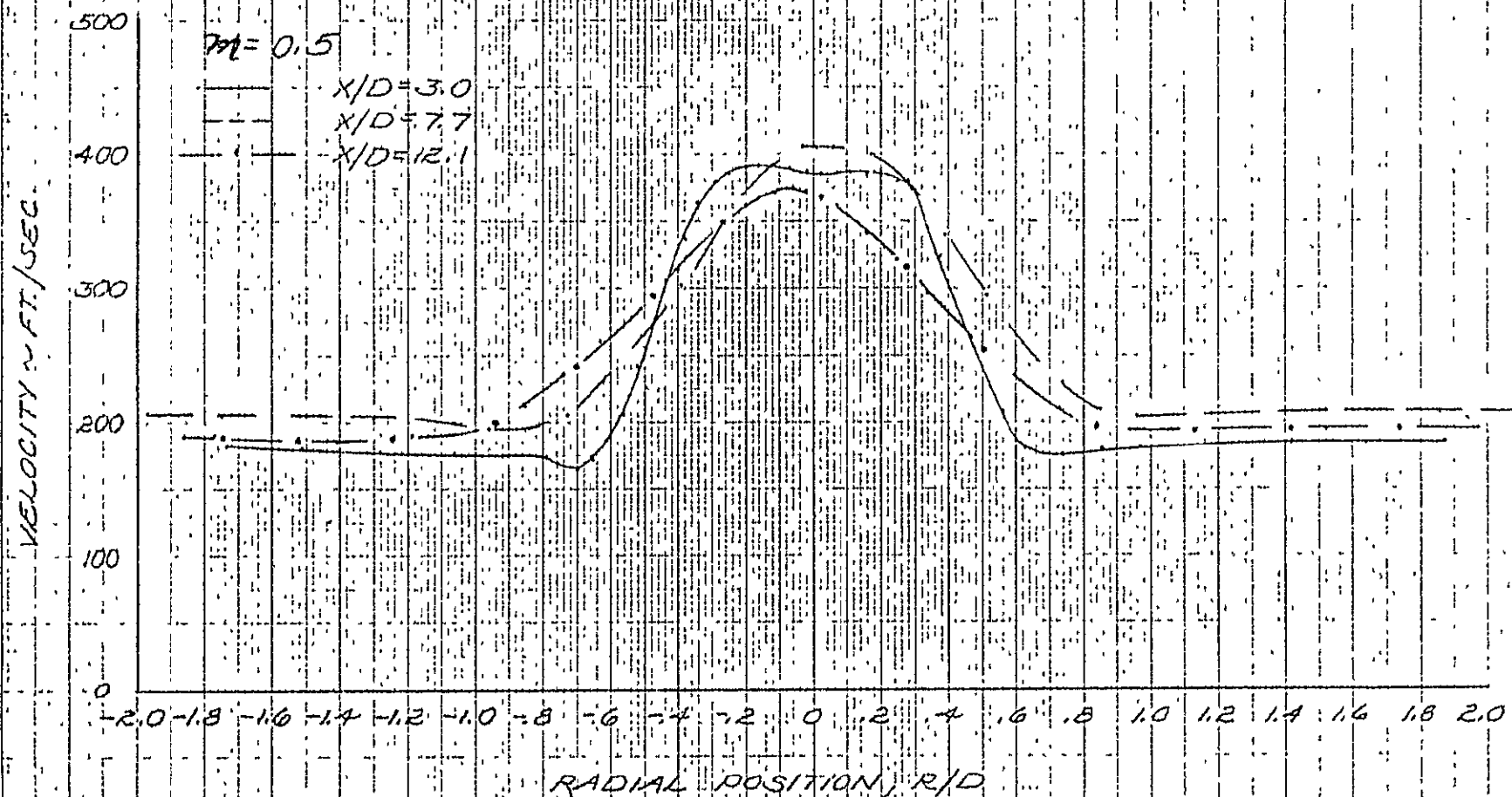
500
 400
 300
 200
 100
 0

-20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18 20

RADIAL POSITION, R/D



MEAN VELOCITY PROFILES



B. Turbulence Intensity Profiles

The turbulence intensities were obtained from the fluctuating voltage signals from the radial probe. The voltage signals were proportional to the turbulence intensities which were read from an RMS AC voltmeter. Plots of turbulence intensity versus normalized radial position, R/D , are shown in Figures B1 through B4 for the various velocity ratios and axial locations.

ORIGINAL PAGE IS
OF POOR QUALITY

TURBULENCE INTENSITY PROFILES

 $M=0$ — $x/D=3.0$ - - - $x/D=5.0$ ORIGINAL PAGE IS
OF POOR QUALITY

% TURBULENCE

RADIAL POSITION, R/D

B-1

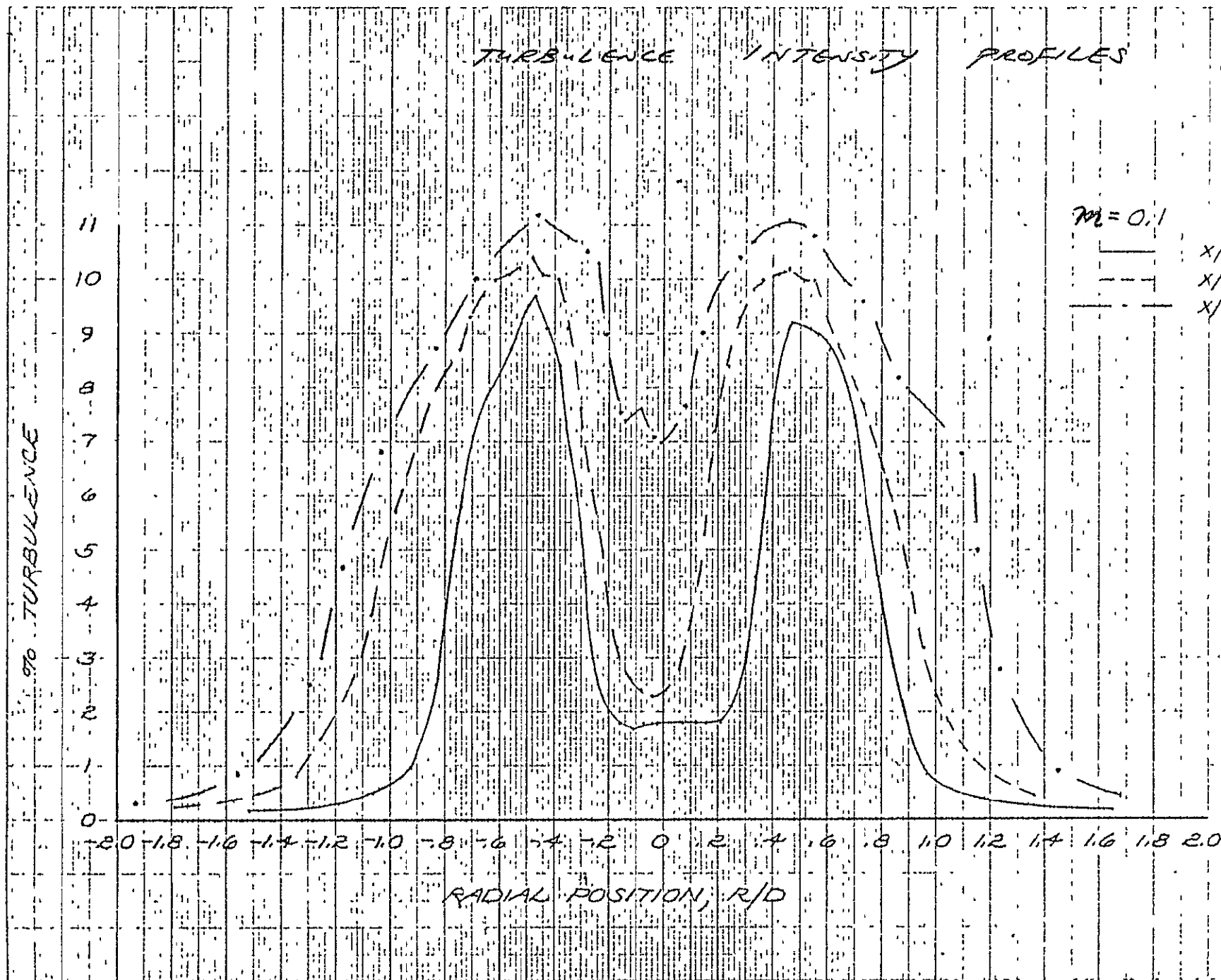
TURBULENCE INTENSITY PROFILES

 $M = 0.1$ $x/D = 3.0$ $x/D = 5.5$ $x/D = 7.7$

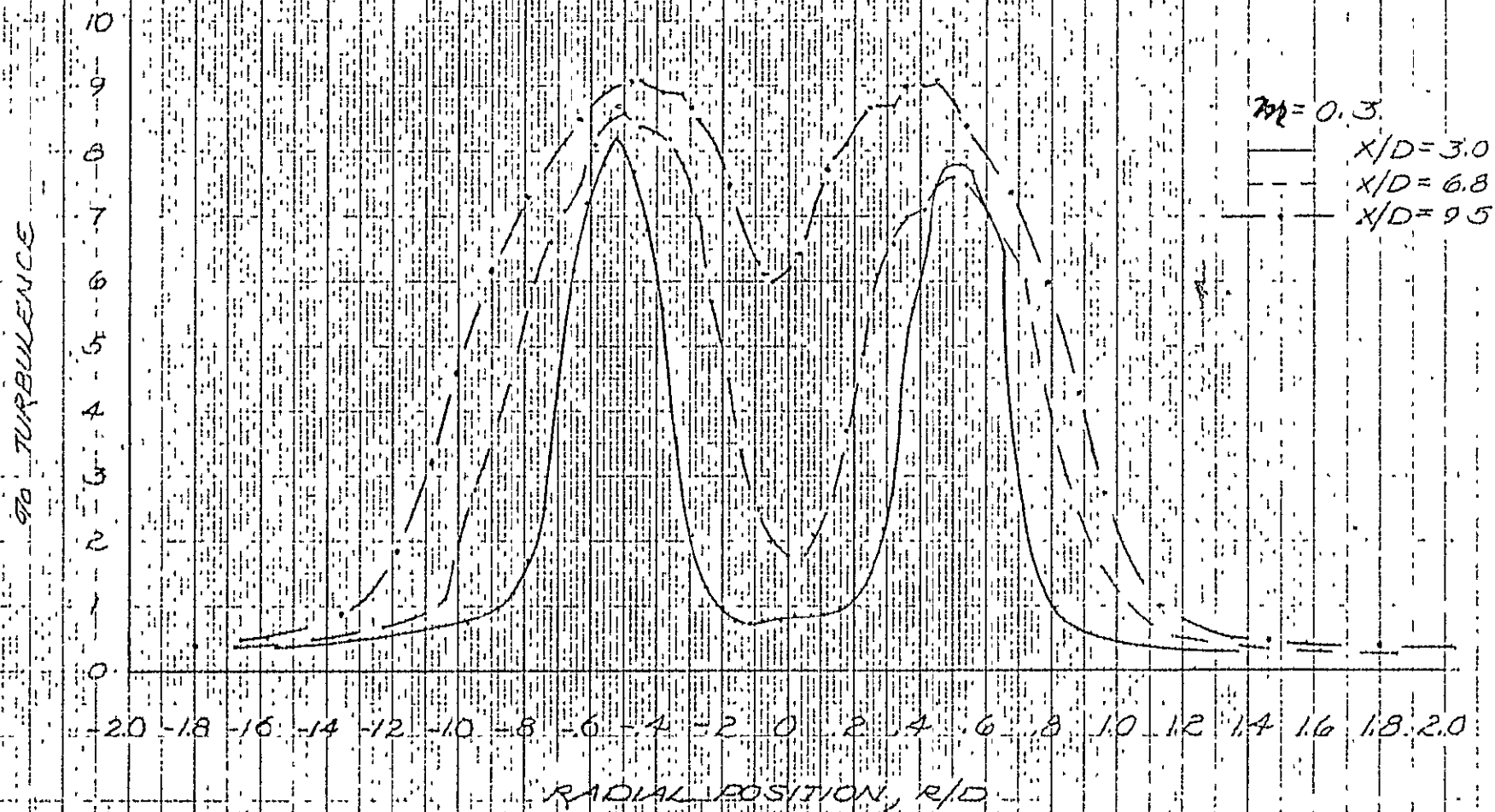
% TURBULENCE

RADIAL POSITION, R/D

B-2



TURBULENCE INTENSITY PROFILES



TURBULENCE INTENSITY PROFILES

8
7
6
5
4
3
2
1
0

% TURBULENCE

$Re = 0.5$

$x/D = 3.0$
 $x/D = 7.7$
 $x/D = 12.1$

-2.0 -1.8 -1.6 -1.4 -1.2 -1.0 -0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0

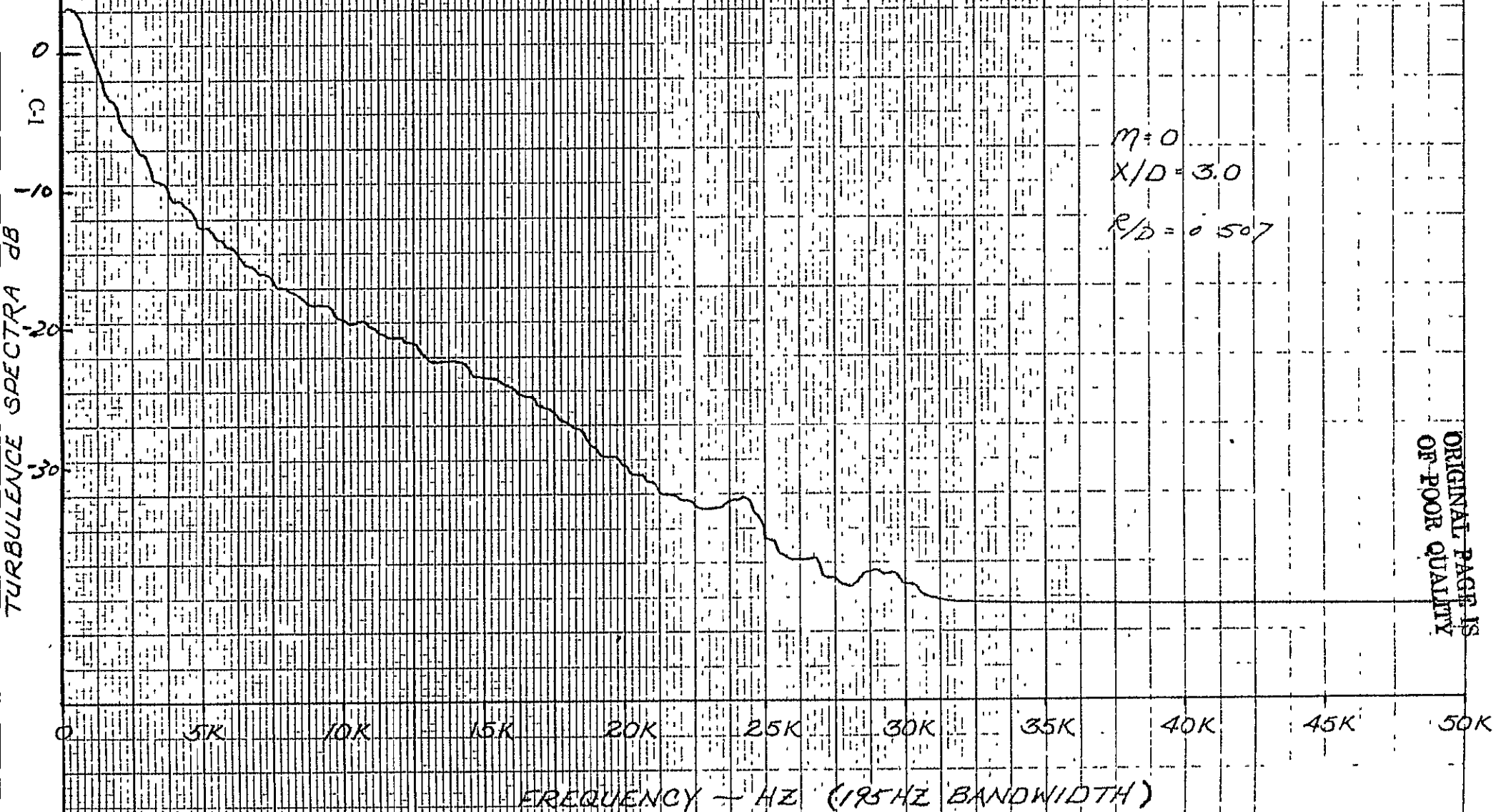
RADIAL POSITION, R/D

C. Normalized Turbulence Spectra

All turbulence spectra were normalized to the same relative level by subtracting the recorded attenuations from the raw data spectra. The frequency bandwidth for the 0-50 KHz spectra is 195 Hz, and the frequency bandwidth for the 0-20 KHz spectra is 78 Hz.

11
ORIGINAL PAGE IS
OF POOR QUALITY

NORMALIZED TURBULENCE SPECTRA



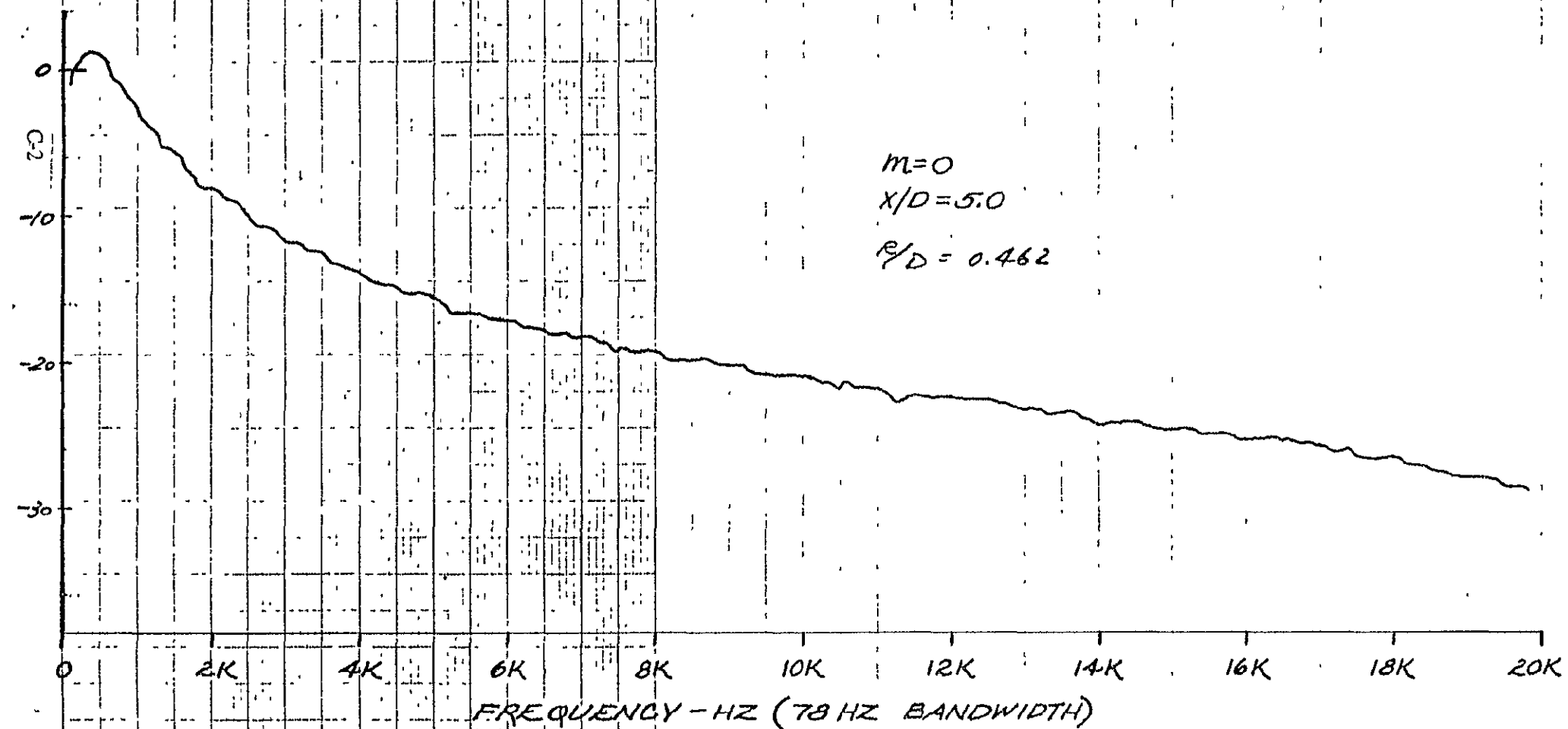
ORIGINAL PAGE IS
OF POOR QUALITY

NORMALIZED TURBULENCE SPECTRA

$M=0$

$X/D=5.0$

$R/D=0.462$



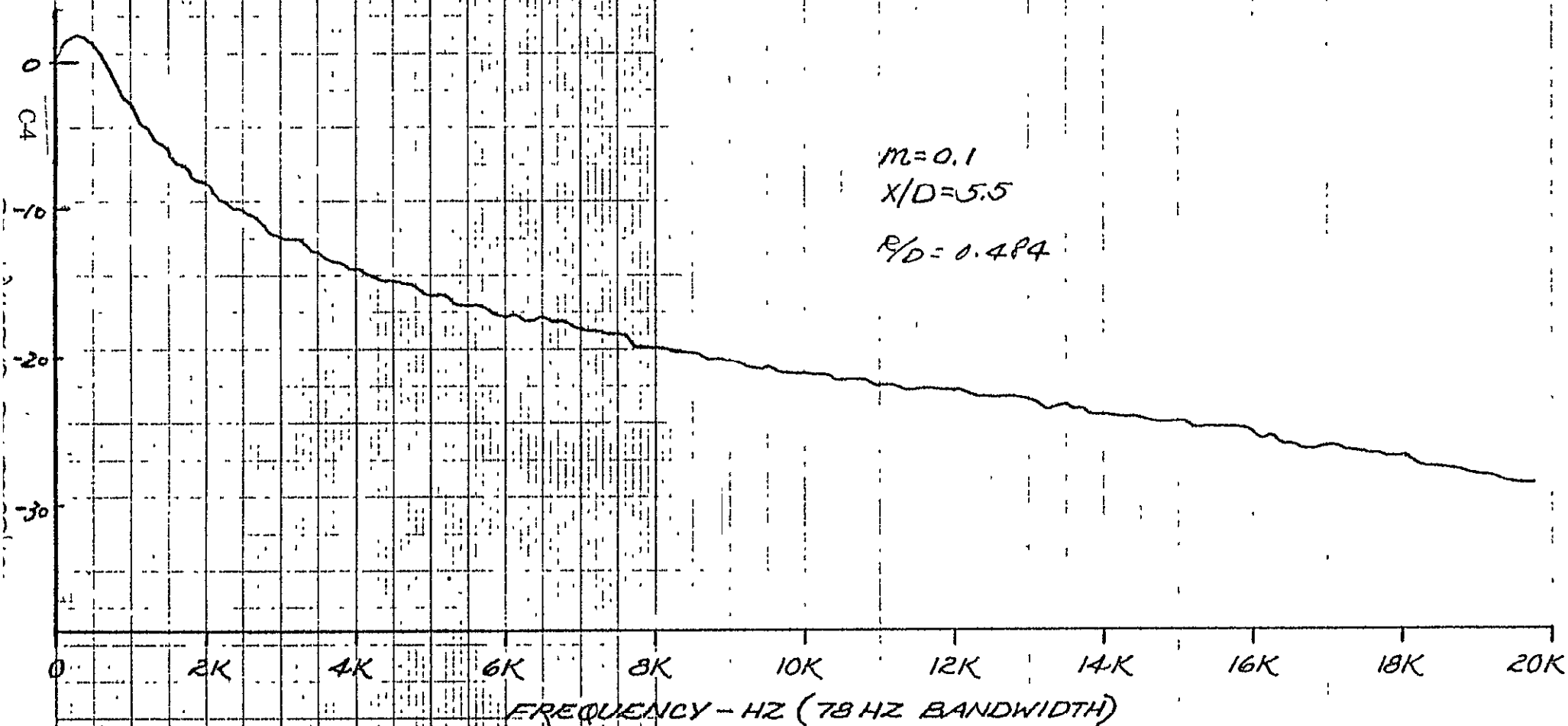
NORMALIZED TURBULENCE SPECTRA

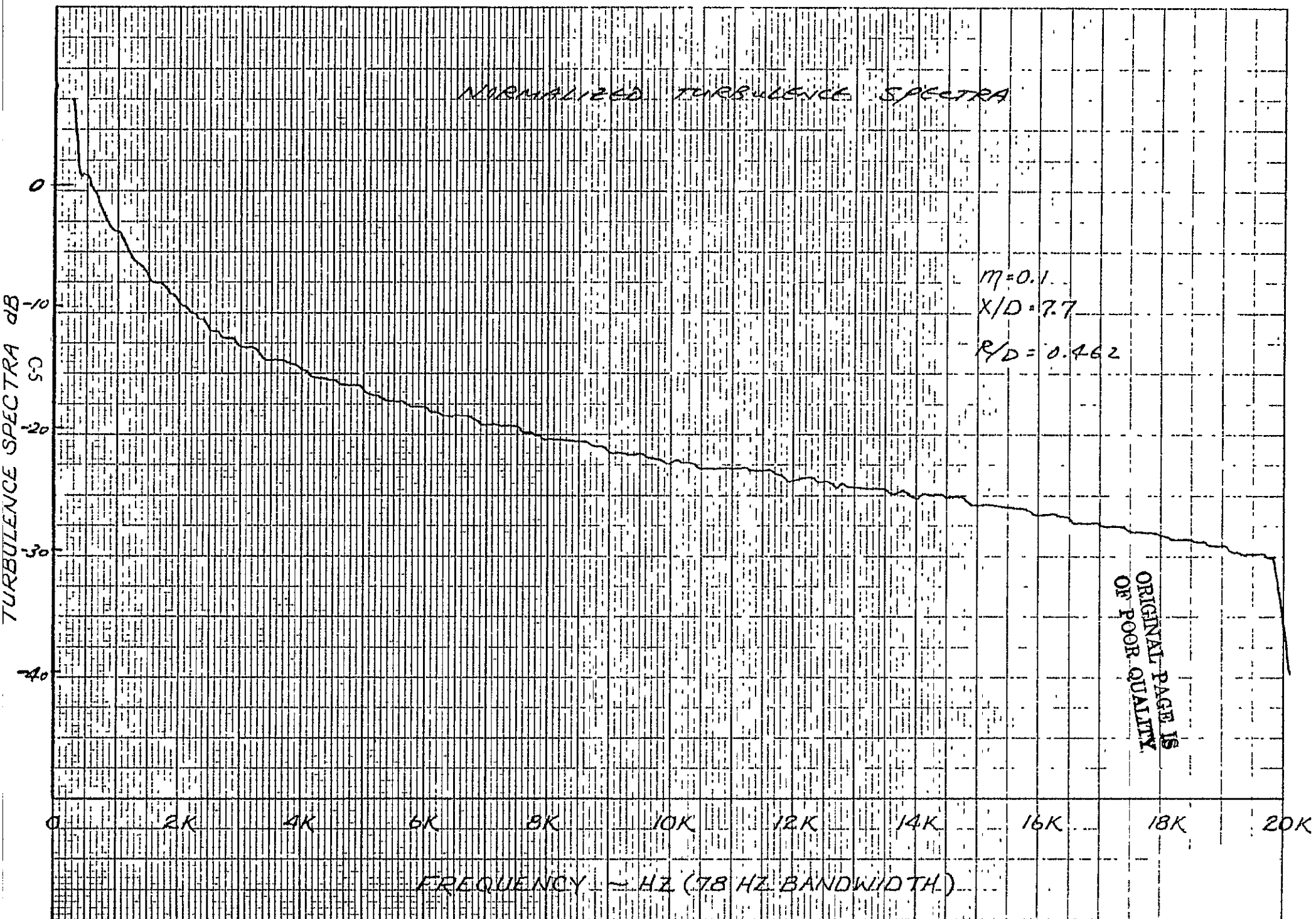
$M = 0.1$
 $X/D = 3.0$
 $R/D = 0.471$

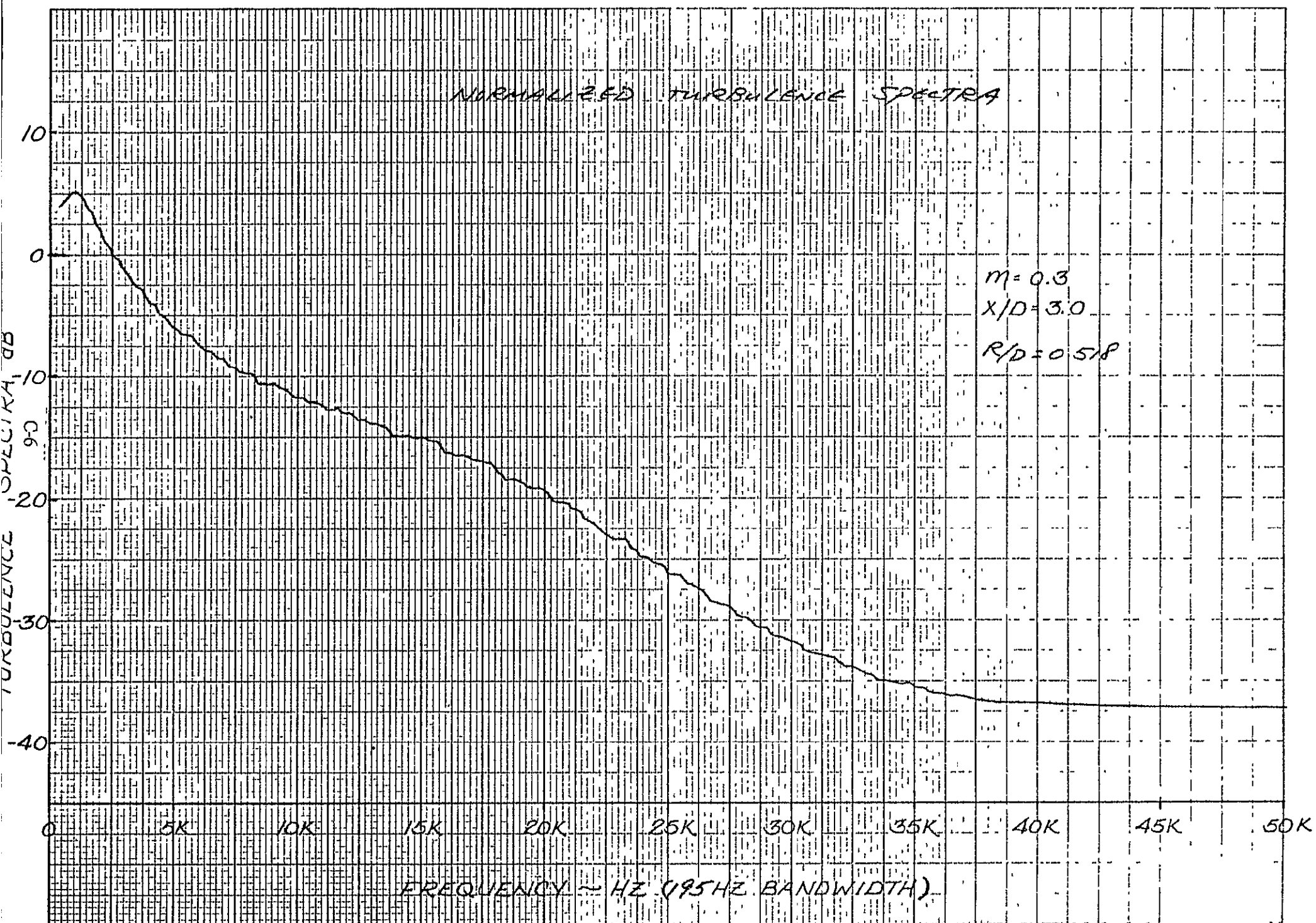
ORIGINAL PAGE IS
OF POOR QUALITY

FREQUENCY ~ HZ (95 HZ BANDWIDTH)

NORMALIZED TURBULENCE SPECTRA

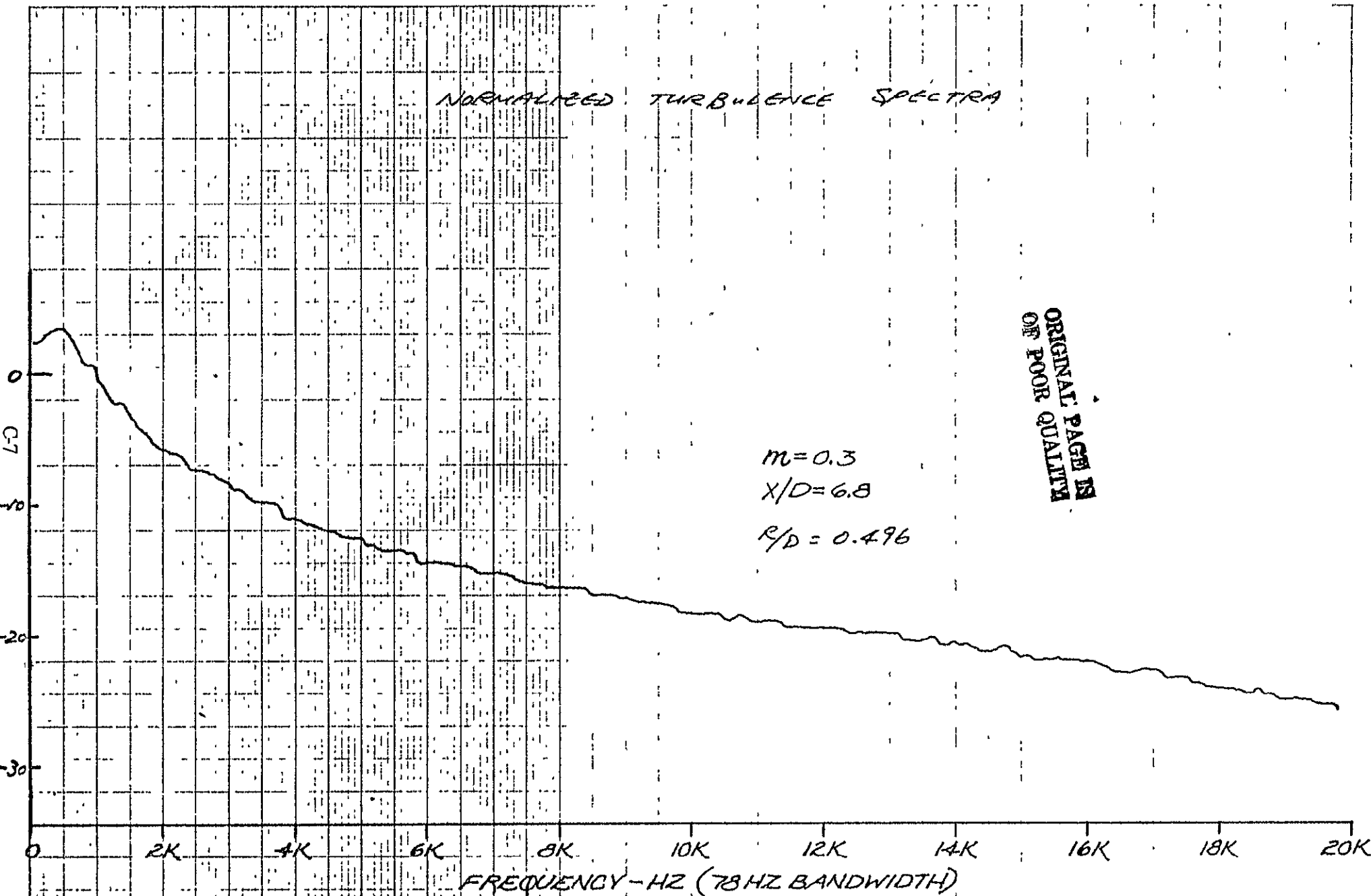




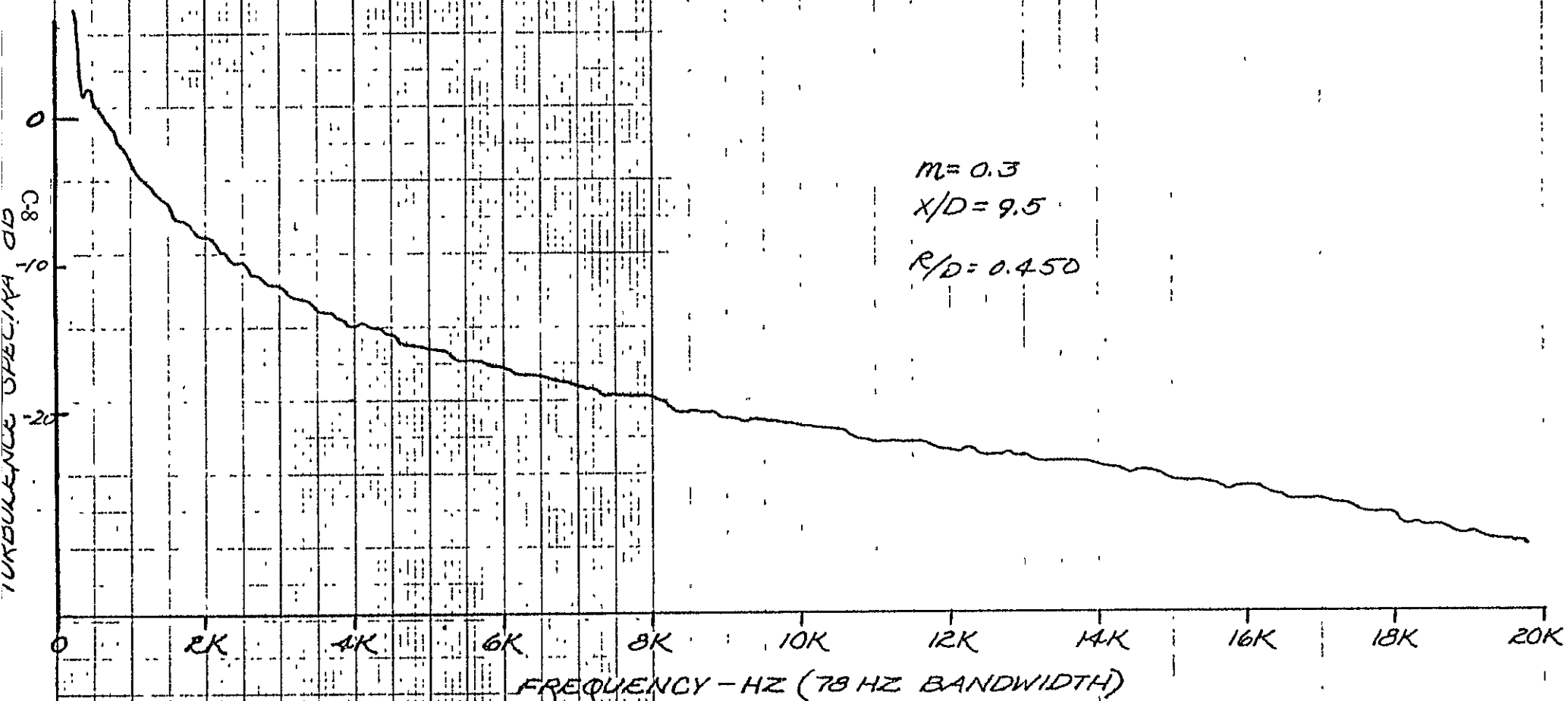


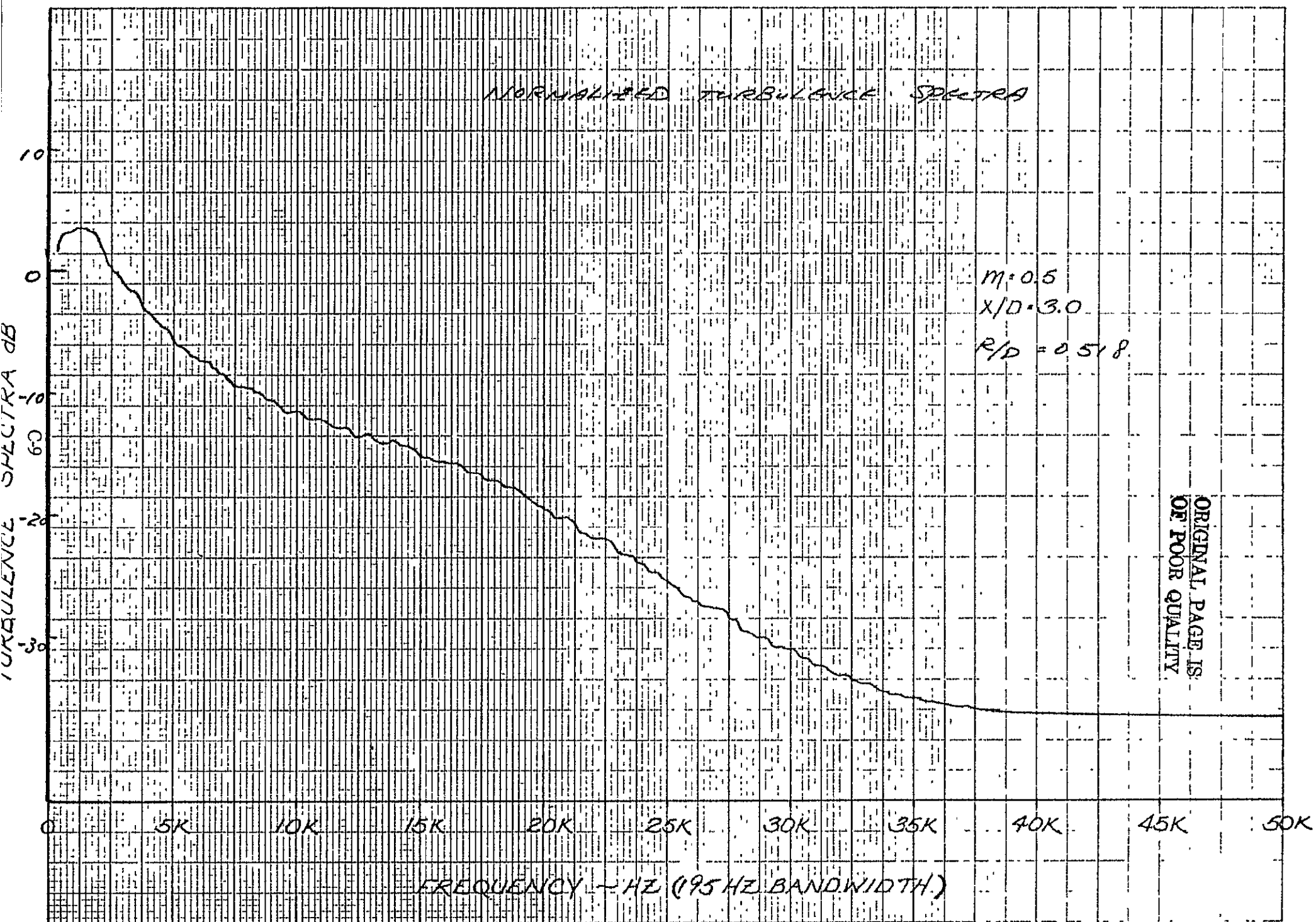
NORMALIZED TURBULENCE SPECTRA

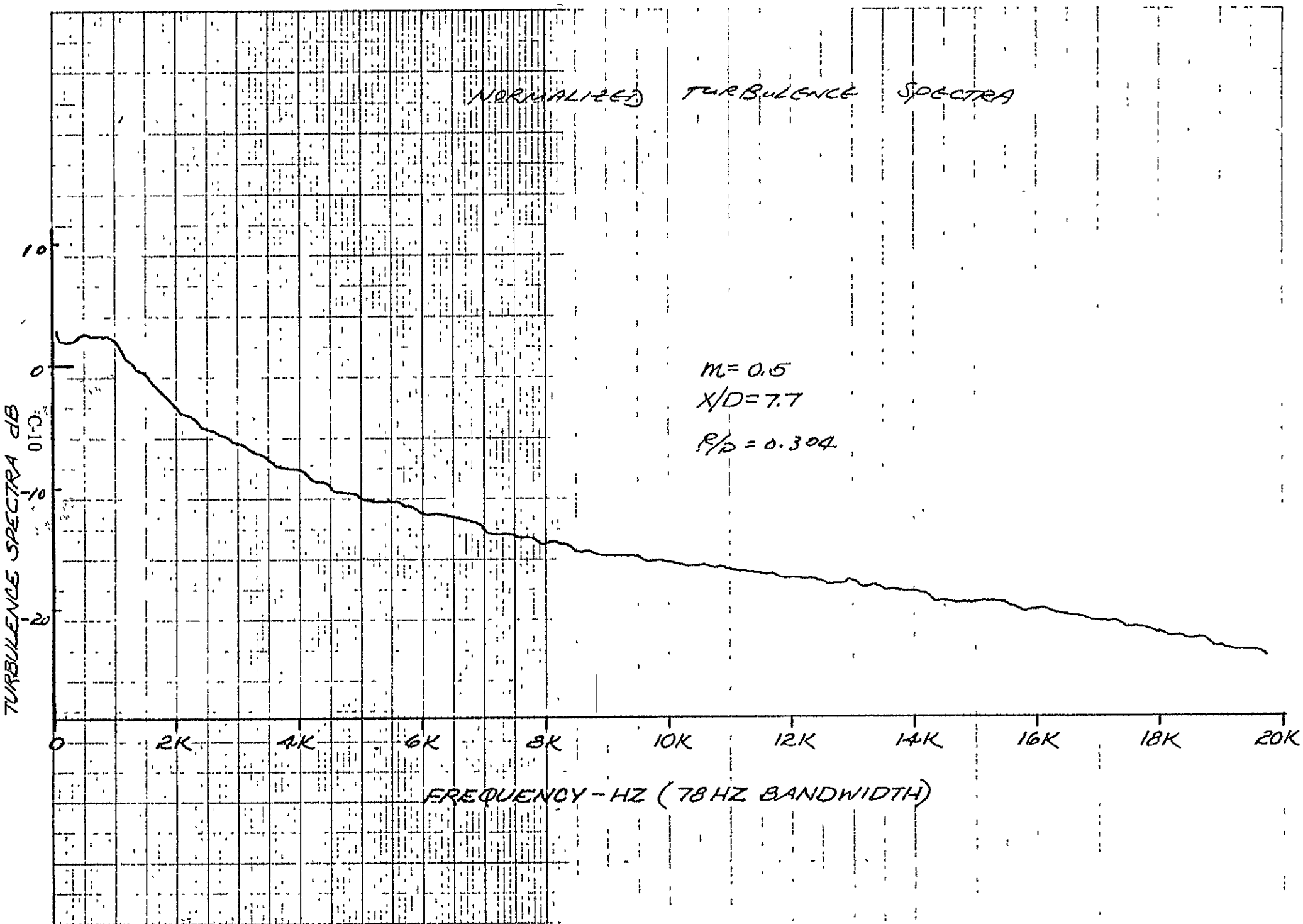
TURBULENCE SPECTRA dB



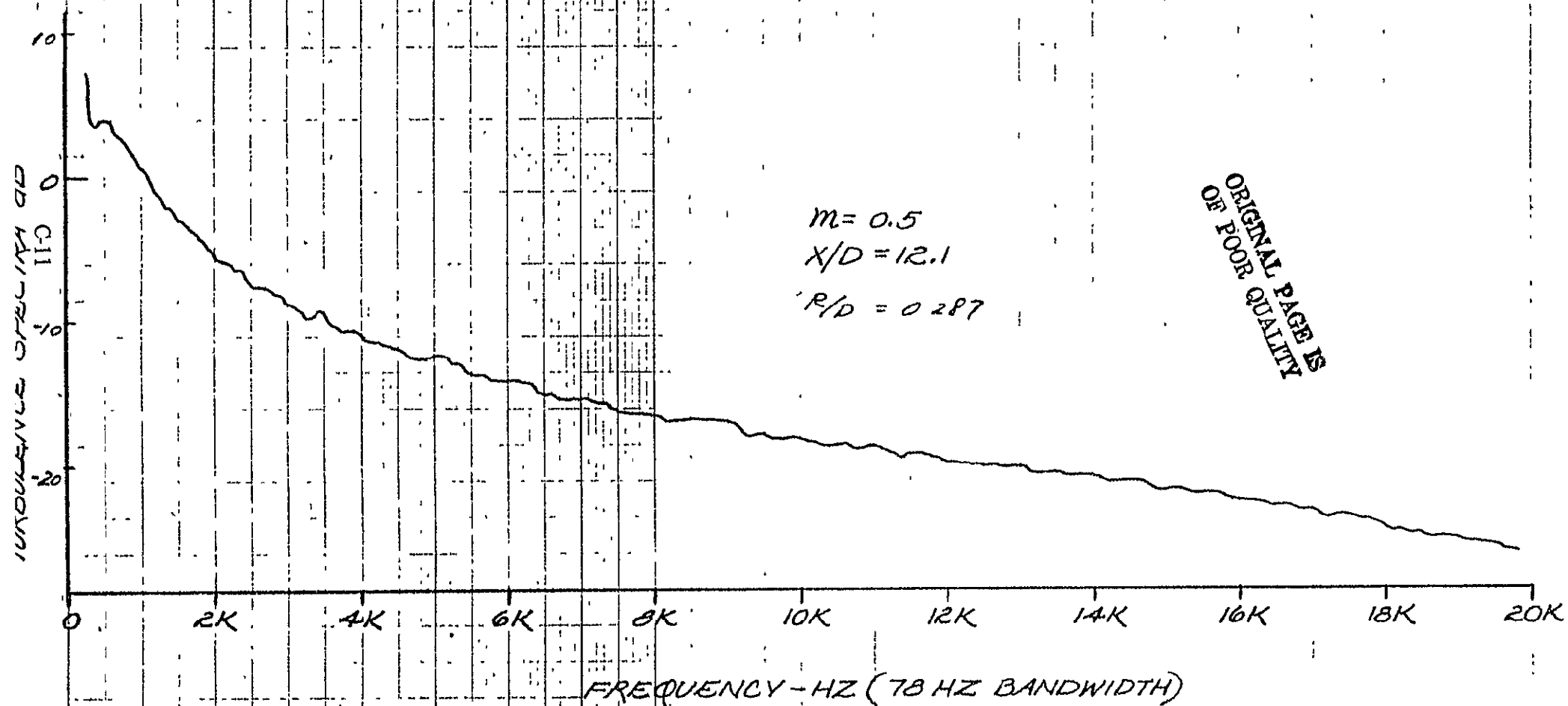
NORMALIZED TURBULENCE SPECTRA







NORMALIZED TURBULENCE SPECTRA



D. Auto and Cross Correlations

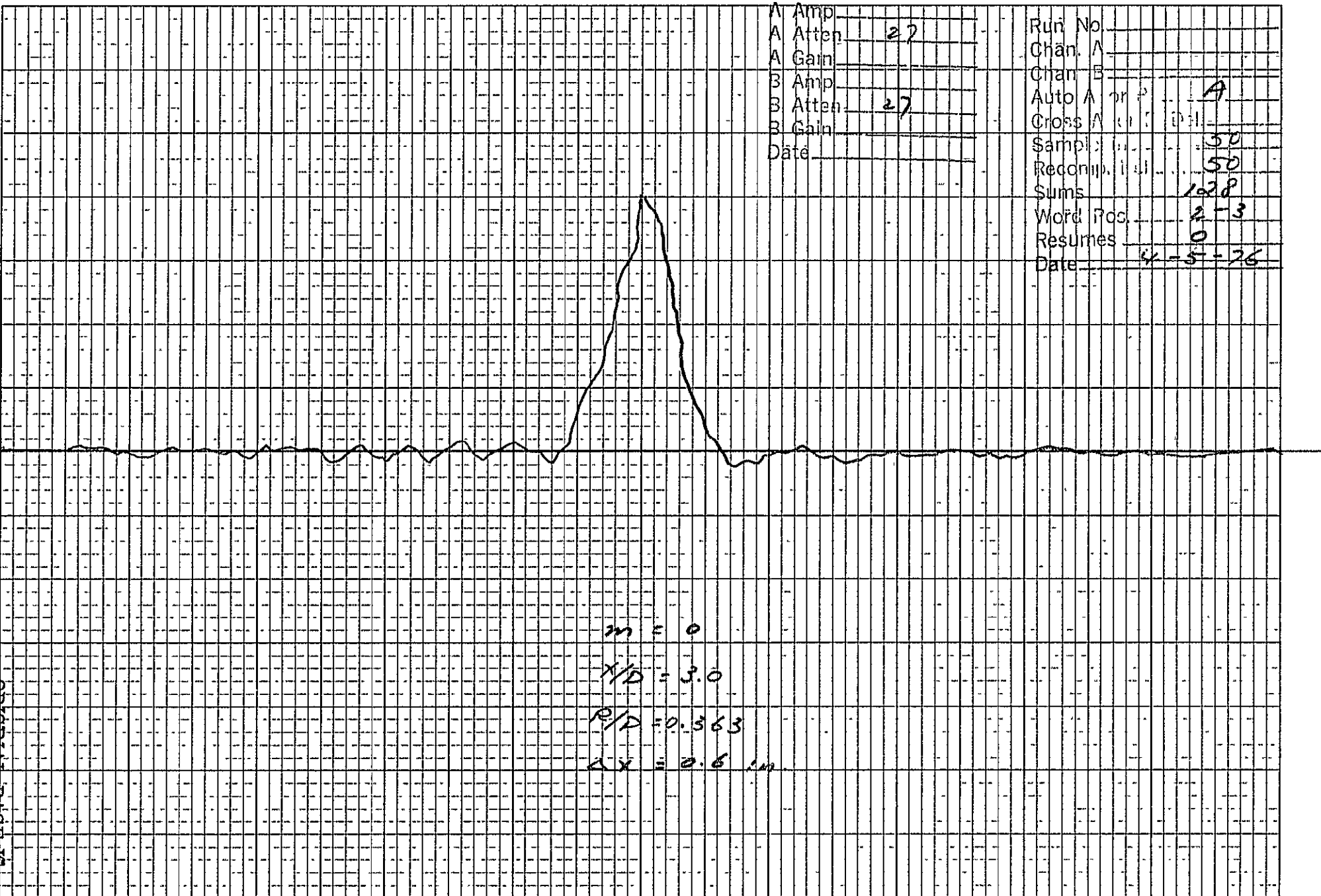
This section contains the raw data from the two probe correlations. The probes were mounted on traverse mechanisms. The upstream probe, denoted as probe "A", traversed radially, while the downstream probe, denoted as probe "B", traversed axially along the jet. The signals from probes "A" and "B" were analyzed to provide autocorrelations and cross correlations for varying values of probe separation. Such correlations are shown in this section. For each radial location, the autocorrelations of probes "A" and "B" are presented first then followed by the cross correlation of probes "A" and "B". For each correlation, the velocity ratio (m), axial location (X/D), radial location (R/D), and probe separation (ΔX) in inches are listed on the bottom center of the plots. Additional information necessary to calculate the normalized cross correlation coefficients are also recorded.

On the left top corner the attenuation of probes "A" and "B" are listed under (A Atten) and (B Atten), respectively. On the right top corner the increments of each unit on the time axis (X coordinate) in microseconds (μ sec. or 10^{-6} seconds) are listed under sample increment (Sample Inc) where the origin of the time axis is listed under (Recomp Del) in terms of units from the left. On the vertical axis (Y coordinate), each unit is equivalent to 1. Other information, such as the word position (Word Pos) and resumes (Resumes) are also recorded. The word position refers to the vertical scale expansion. A word position of 2-3 means that the displayed vertical scale was expanded by a factor of 2^3 or 8, and therefore the actual level must be multiplied by $1/8$. Each resume increases the number of data points in the ensemble average by an equal amount. The procedure to calculate the cross correlation coefficients using the preceding information is described in Section F.

In this section the signals from both probes were band-pass filtered from 0-20 KHz to remove a spurious electrical resonance in the frequency range of 200 to 500 KHz.

A Amp
A Atten 27
A Gain
B Amp
B Atten 27
B Gain
Date

Run No
Chan. A
Chan. B
Auto A or B A
Cross A or B
Sample 50
Reconip. 50
Sums 1028
Word Pos. 2-3
Resumes 0
Date 4-5-76

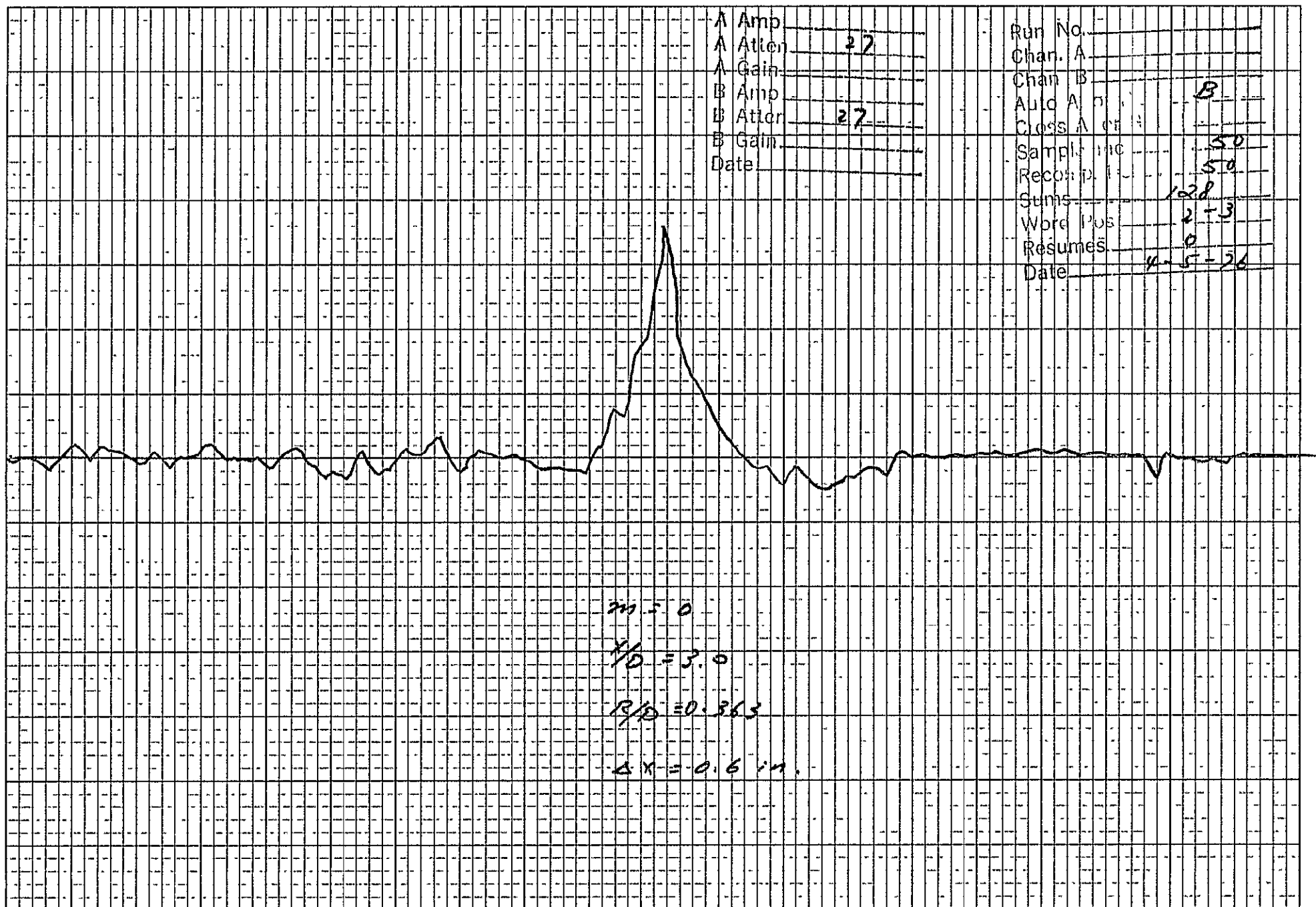


D-1

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp
A Atten 27
A Gain
B Amp
B Atten 27
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A on B
Cross A on
Sample inc 50
Recomp. inc 50
Sums 128
Word Pos 2-3
Resumes 0
Date 4-5-76



$m = 0$

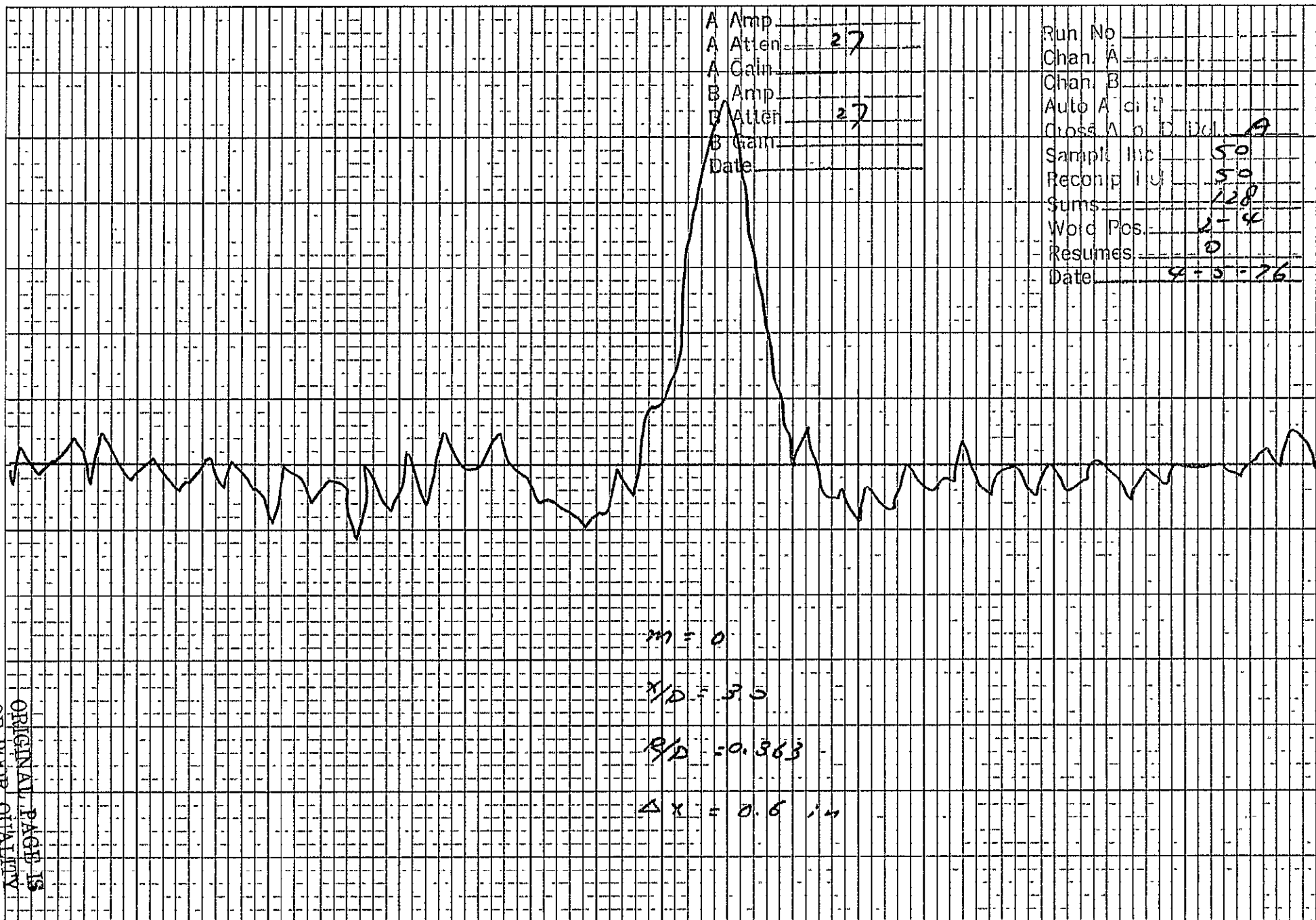
$N/D = 3.0$

$R/D = 0.363$

$\Delta x = 0.6 \text{ in.}$

A Amp
A Atten 27
A Gain
B Amp
B Atten 27
B Gain
Date

Run No
Chan. A
Chan. B
Auto A Gain
Cross A to D Del. A
Sample Inc 50
Recomp IU 50
Sums 128
Word Pos. 1-4
Resumes 0
Date 4-5-76



$$m = 0$$

$$x/d = 3.5$$

$$p/d = 0.363$$

$$\Delta x = 0.6 \text{ in}$$

D-3

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date APR 5 1976

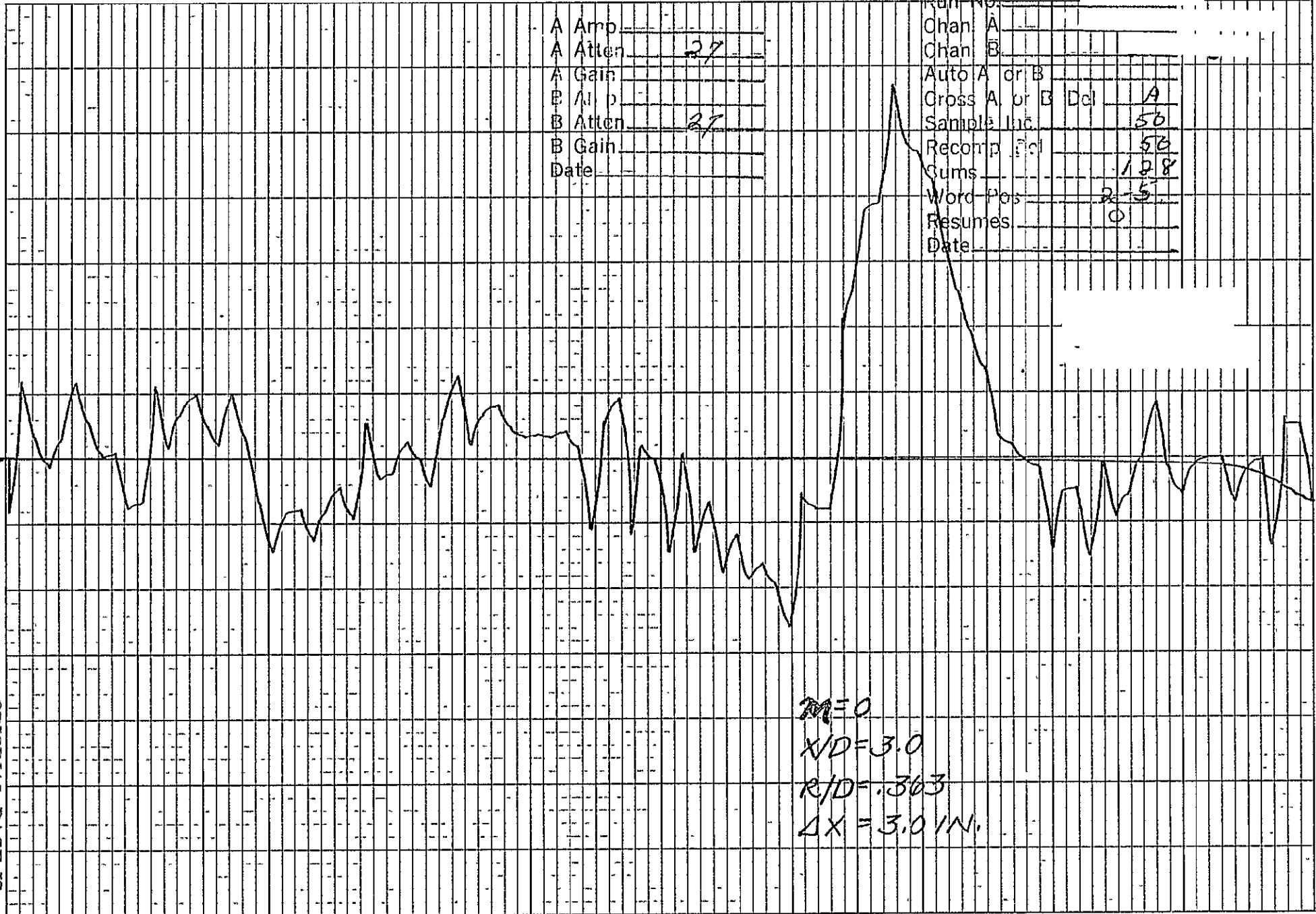
Run No. _____
Chan A _____
Chan B _____
Auto A. or B. B
Gross A. or B. Del _____
Sample Inc. 50
Record Int. 50
Sumis 128
Word Pos 2-3
Resumes 0
Date APR 5 1976

D-4

$m = 0$
 $X/D = 3.0$
 $R/D = .363$
 $\Delta X = 3.0 \text{ IN.}$

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del A
Sample Inc 50
Recomp. Inc 50
Cums 128
Word Pos 2-5
Resumes 0
Date _____



$M=0$
 $X/D=3.0$
 $R/D=.363$
 $\Delta X=3.0 \text{ IN.}$

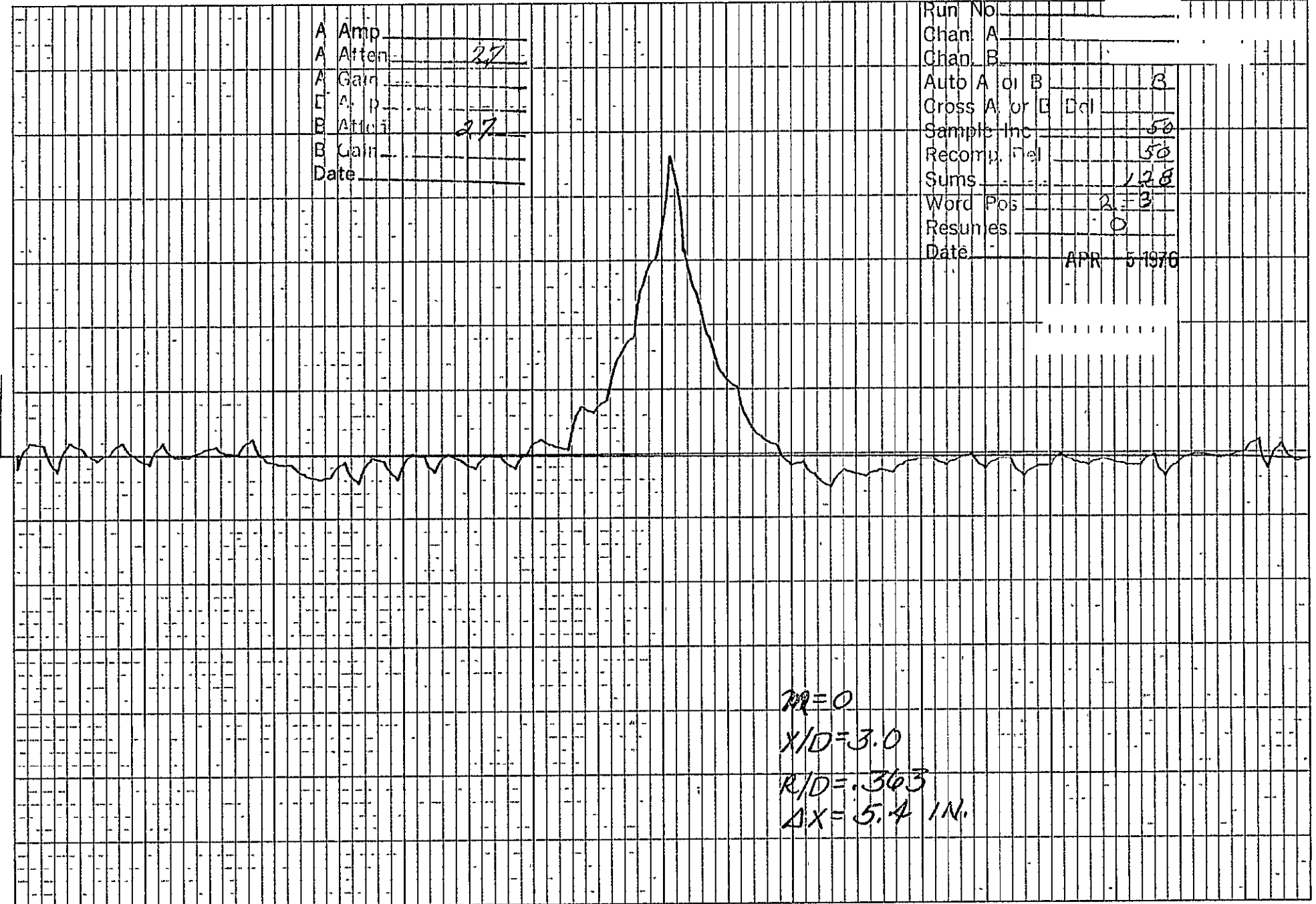
D-5

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 27
A Gain _____
A. D. _____
B Atten 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B B
Cross A or B Dcl _____
Sample Inc 50
Recomp. Del 50
Sums 128
Word Pos 2-3
Resumes 0
Date APR 5 1976

D-6



A Amp
A Attch 27
A Gain
A Lin
B Attch 27
B Gain
Date

Run No
Chan A
Chan B
Auto A or B
Gross A or B. Del 2
Sample Inc. 50
Recomp. Del 50
Sums 1.28
Word Pos R-5
Resumes
Date APR 5 1976

D-7

ORIGINAL PAGE 13
OF POOR QUALITY

M=0
X/D=3.0
R/D=3.63
 $\Delta X = 5.4 \text{ IN.}$

$R = 0.0$ (max shear)

A Amp _____
 A Atten 2.7
 A Gain _____
 B Amp _____
 B Atten 2.7
 B Gain _____
 Date _____

Run No. _____
 Chan. A _____
 Chan. B _____
 Auto A or B _____
 Cross A or B Del. _____
 Sample Rate 50
 Record Length 50
 Summ. 128
 Word Fds 2-3
 Resumes _____
 Date APR 5 1976

D-8

$m = 0$
 $\frac{x}{D} = 3.0$
 $\frac{R}{D} = 0.507$
 $\Delta X = 0.61 \text{ IN.}$

A Amp
A Atten 2.7
A Gain
E Amp
E Atten 2.7
E Gain
Date

Run No
Chan A
Chan B
Auto A. or B
Cross A. or B. De A
Sample Inc 50
Recon. 50
Suns 12.8
Work Pos 2-4
Resumes 2
Date APR 5 1976

D-9

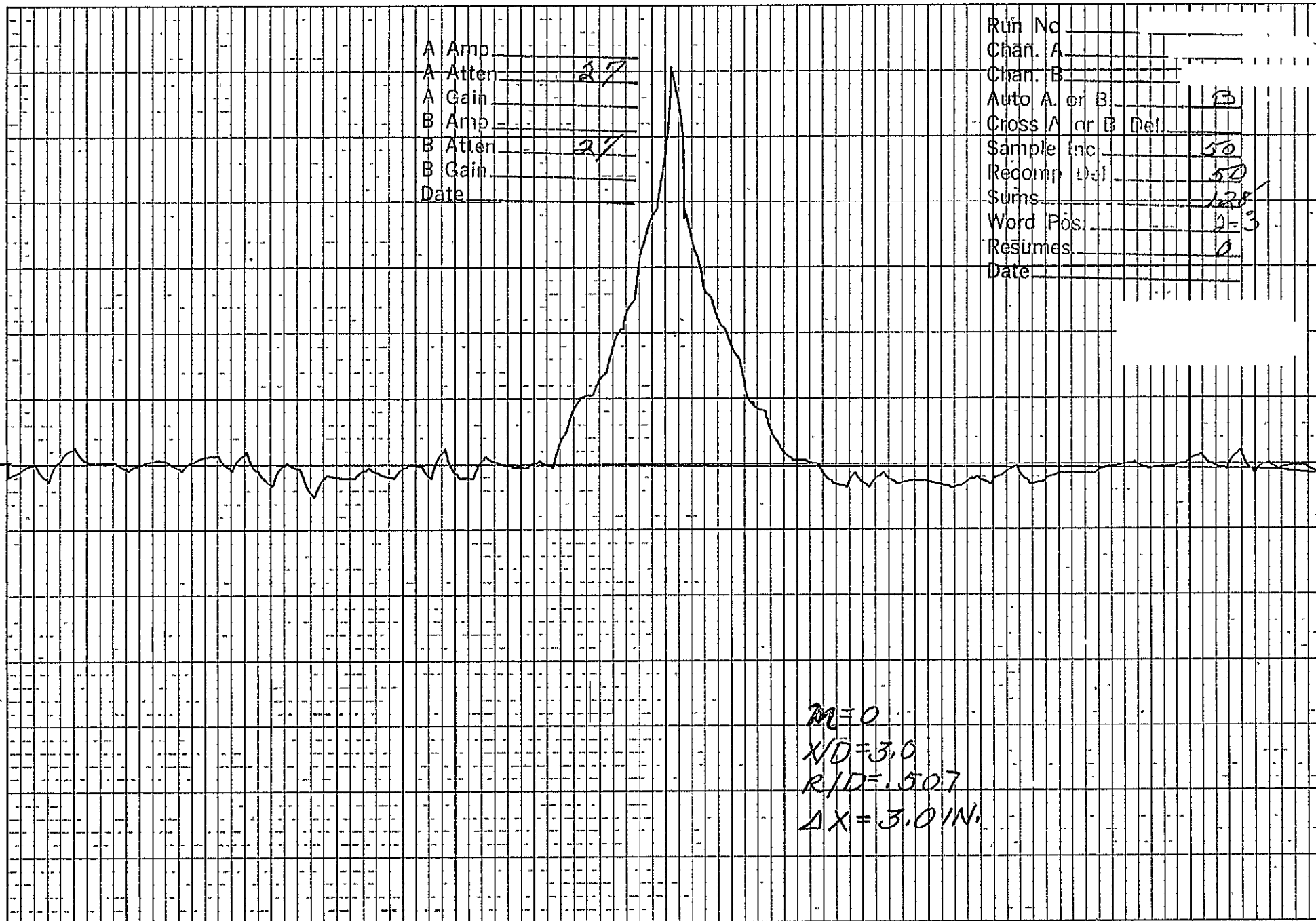
$M=0$
 $X/D=3.0$
 $R/D=.507$
 $\Delta X=.6$ IN.

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No _____
Chan. A _____
Chan. B _____
Auto A. or B. B
Cross A. or B. Del. _____
Sample Inc. 50
Recomp Del. 50
Sums 128
Word Pos. 2-3
Resumes 0
Date _____

D-10



$M=0$
 $X/D=3.0$
 $R/D=.507$
 $\Delta X=3.0 \text{ IN.}$

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No _____
Chan A _____
Chan B _____
Auto A or B _____
Cross A or B D-I A
Sample no 50
Recomp. D-I 50
Sum 12.8
Word Pcs 2-5
Resumes 0
Date APR 5 1976

D-11

$M=0$
 $X/D=3.0$
 $R/D=.507$
 $\Delta X=3.0 \text{ IN.}$

A Amp
A Atten 26
A Gain
E Amp
E Atten 26
E Gain
Date

Run No
Chan A
Chan B
Auto A 3
Cross A or B 3
Sample 100
Record 50
Sum 128
Word 22
Resumes 2
Date APR 5 1975

D-12

$M=0$
 $X/D=3.0$
 $R/D=.507$
 $\Delta X=5.4 \text{ IN.}$

A Amp
A Att'n 26
A Gain
B Amp
B Att'n 26
B Gain
Date

Run No
Chan. A
Chan. B
Auto A or B
Cross A or B Del A
Sample Inc 100
Recom. Del 50
Sums 128
Word Prg 2-5
Resumes 1
Date APR 5 1976

D-13

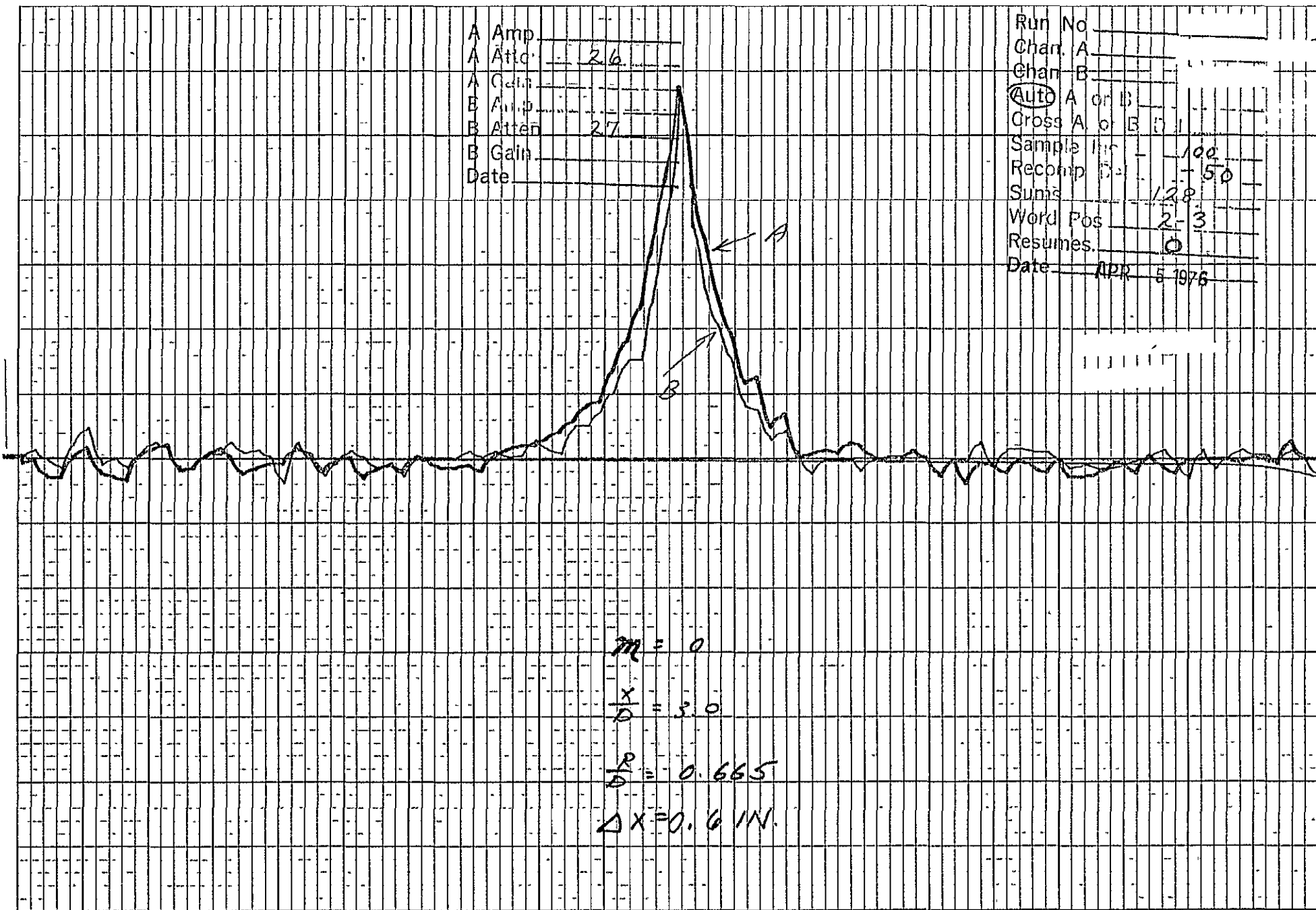
ORIGINAL PAGE IS
OF POOR QUALITY

$M=0$
 $X/D=3.0$
 $R/D=.507$
 $\Delta X=3.41N$

A Amp
A Attc 2.6
A Gain
B Amp
B Attc 2.7
B Gain
Date

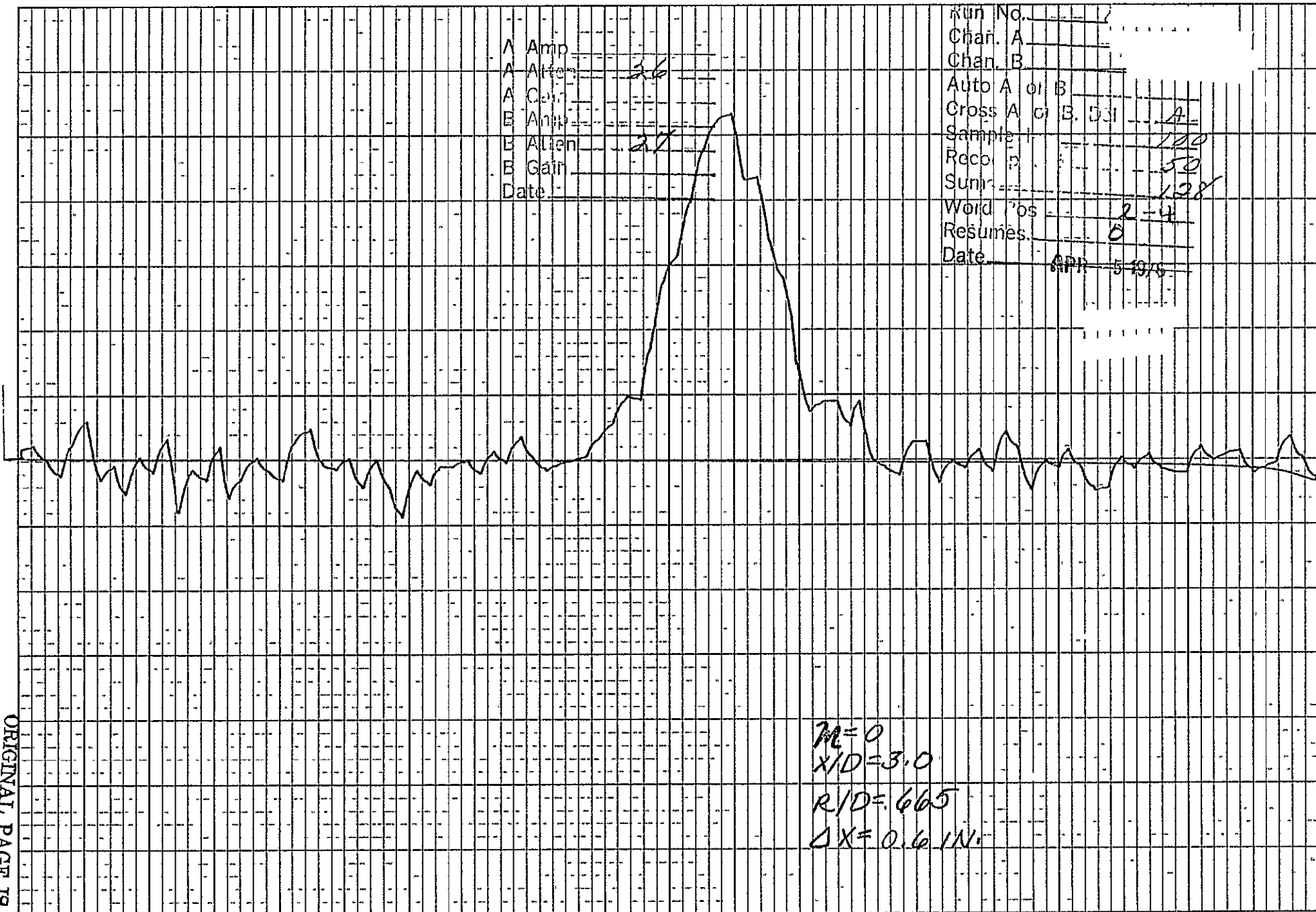
Run No
Chan A
Chan B
(Auto) A or B
Cross A or B ()
Sample Inc 100
Recomp 50
Sum 128
Word Pos 2-3
Resumes 0
Date Apr 5 1976

D-14



A Amp
A Attenuation 2.6
A Gain
B Amp
B Attenuation 2.7
B Gain
Date

Run No. 1
Chan. A
Chan. B
Auto A or B
Cross A or B. D31 4
Sample 1 120
Recomp 50
Sum 128
Word Pos 2-4
Resumes 0
Date APR 5 1976



$M=0$
 $X/D=3.0$
 $R/D=665$
 $\Delta X=0.61N$

A Amp
A Atten 26
A Gain
B Amp
B Atten 27
B Gain
Date

Run No
Chan. A
Chan. B
Auto A B
Cross A or B
Sample Int 100
Rate 50
Sum 128
Word Pos 2-3
Resumes 0
Date APR 5 1976

D-16

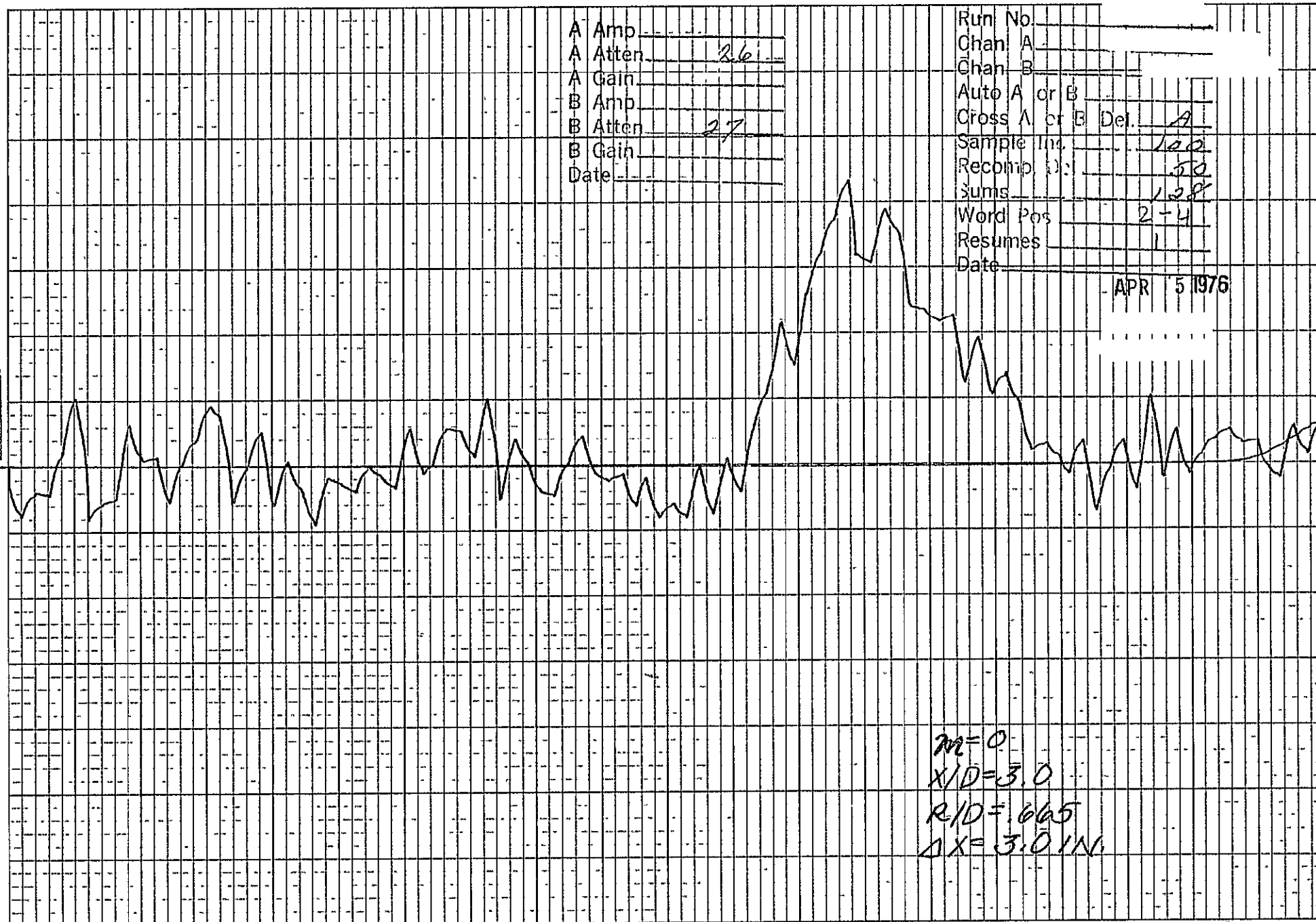
$M=0$
 $X/D=3.0$
 $R/D=.665$
 $\Delta X=3.0 \text{ IN.}$

A Amp _____
A Atten 2.6
A Gain _____
B Amp _____
B Atten 2.7
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del. A
Sample Inc. 100
Recomp. (s) 50
Sums 1.28
Word Pos 2-4
Resumes 1
Date _____

APR 5 1976

D-17

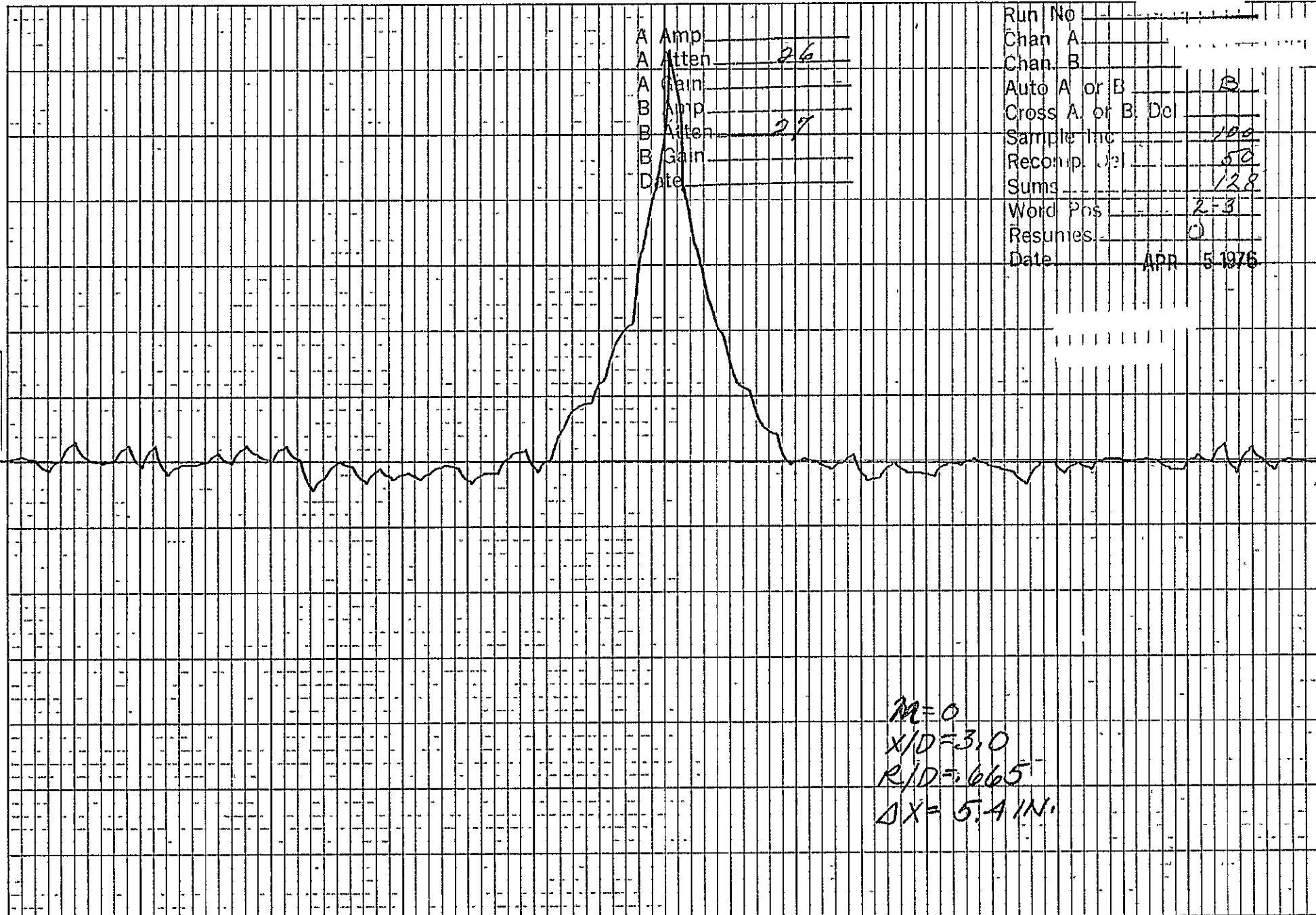


$m=0$
 $X/D=3.0$
 $R/D=.665$
 $\Delta X=3.0 IN.$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No _____
Chan A _____
Chan B _____
Auto A or B B
Cross A or B Del _____
Sample Inc 100
Reconip. % 50
Sums 128
Word Pos 2-3
Resumes 0
Date APR 5 1976

D-18



$M=0$
 $X/D=3.0$
 $R/D=0.665$
 $\Delta X=5.4 \text{ IN.}$

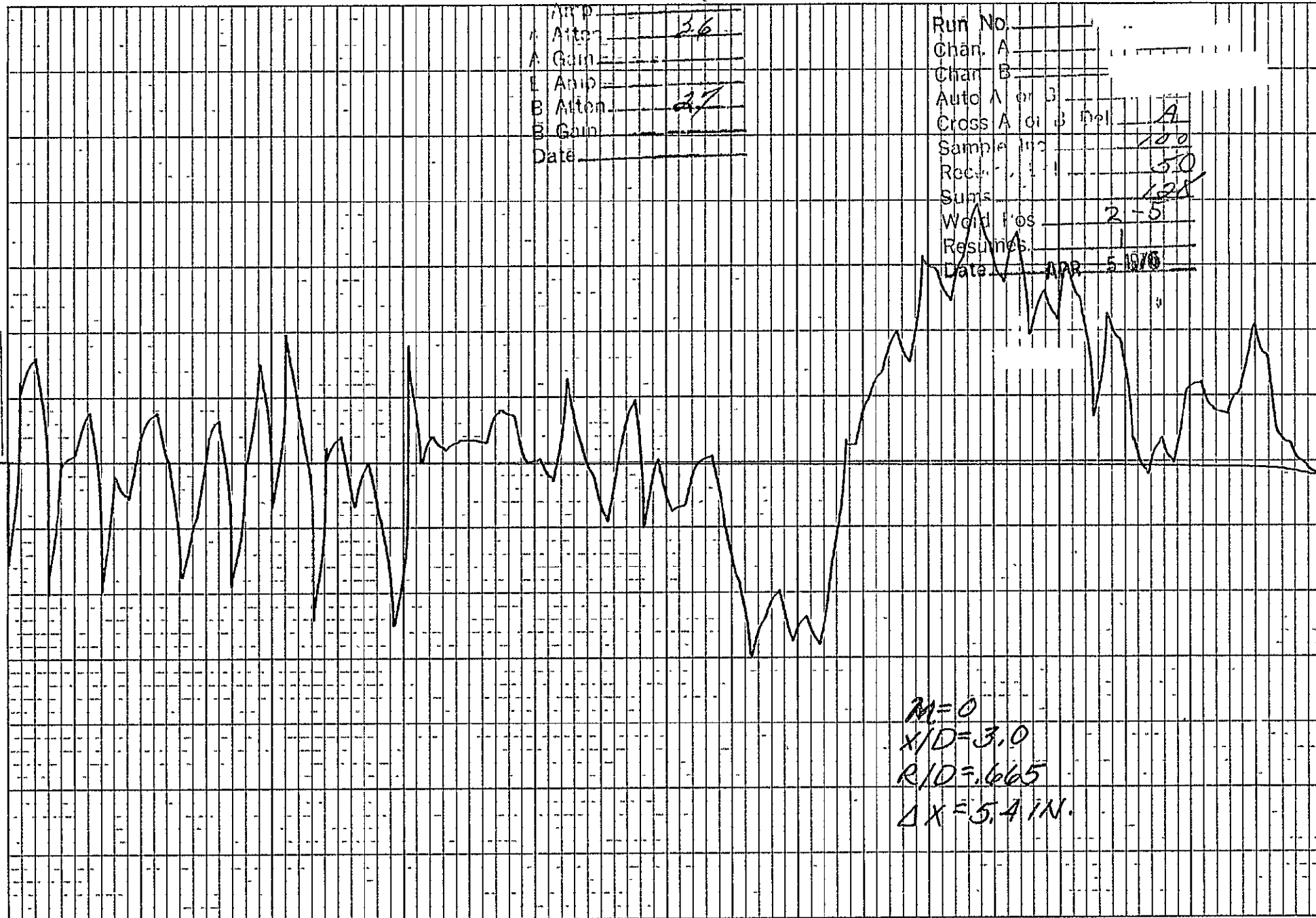
ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Sel. A
Sample Int. 100
Recor. Int. 50
Summ. 128
Word Pos. 2-5
Resumes. 1
Date APR 5 1970

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Sel. A
Sample Int. 100
Recor. Int. 50
Summ. 128
Word Pos. 2-5
Resumes. 1
Date APR 5 1970

D-19

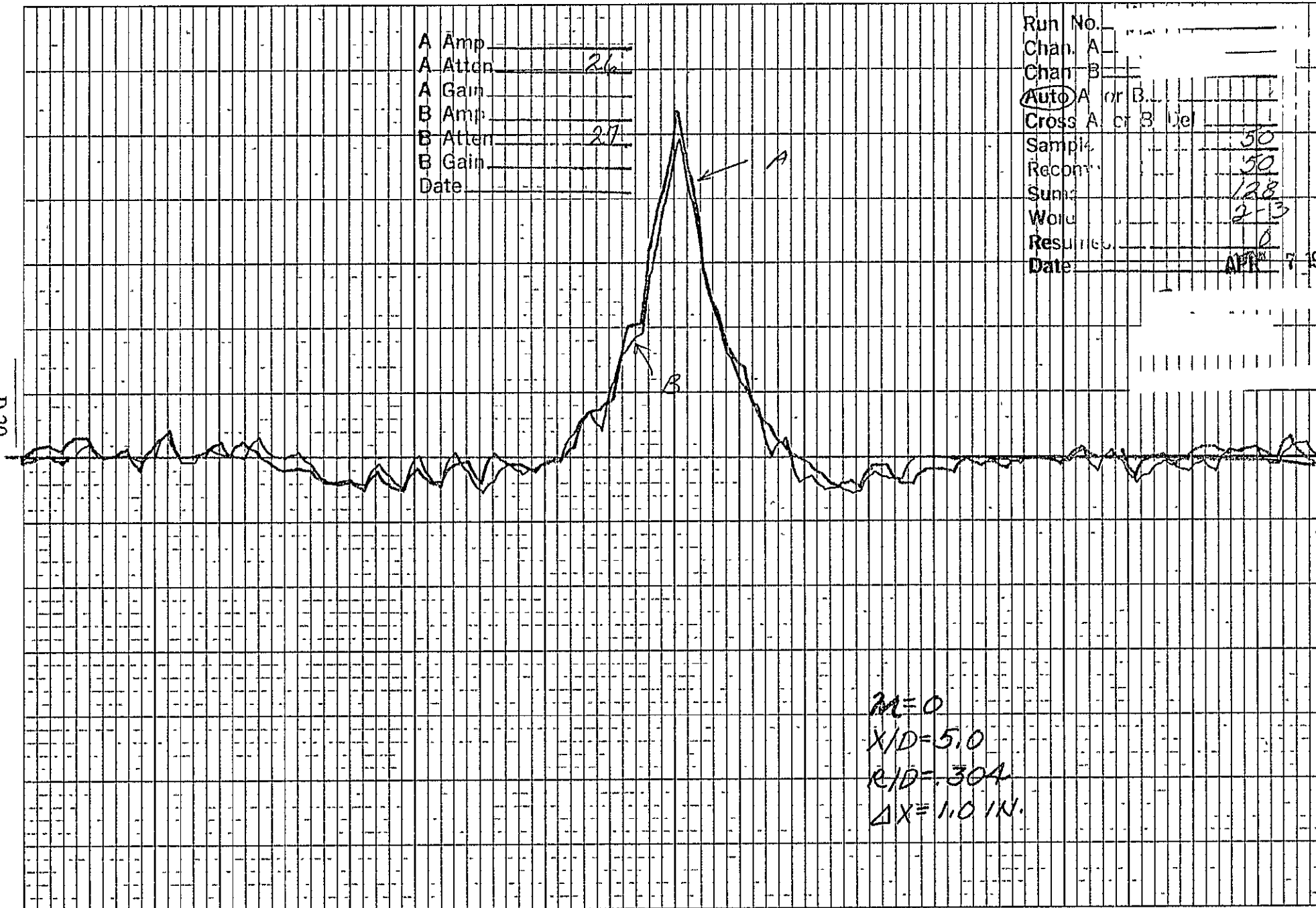


$M=0$
 $X/D=3.0$
 $R/D=.665$
 $\Delta X=5.4 \text{ IN.}$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del _____
Sample _____ 50
Recon _____ 50
Sum _____ 128
Word _____ 2-13
Result _____ 0
Date _____ APR 7 1976

D-20



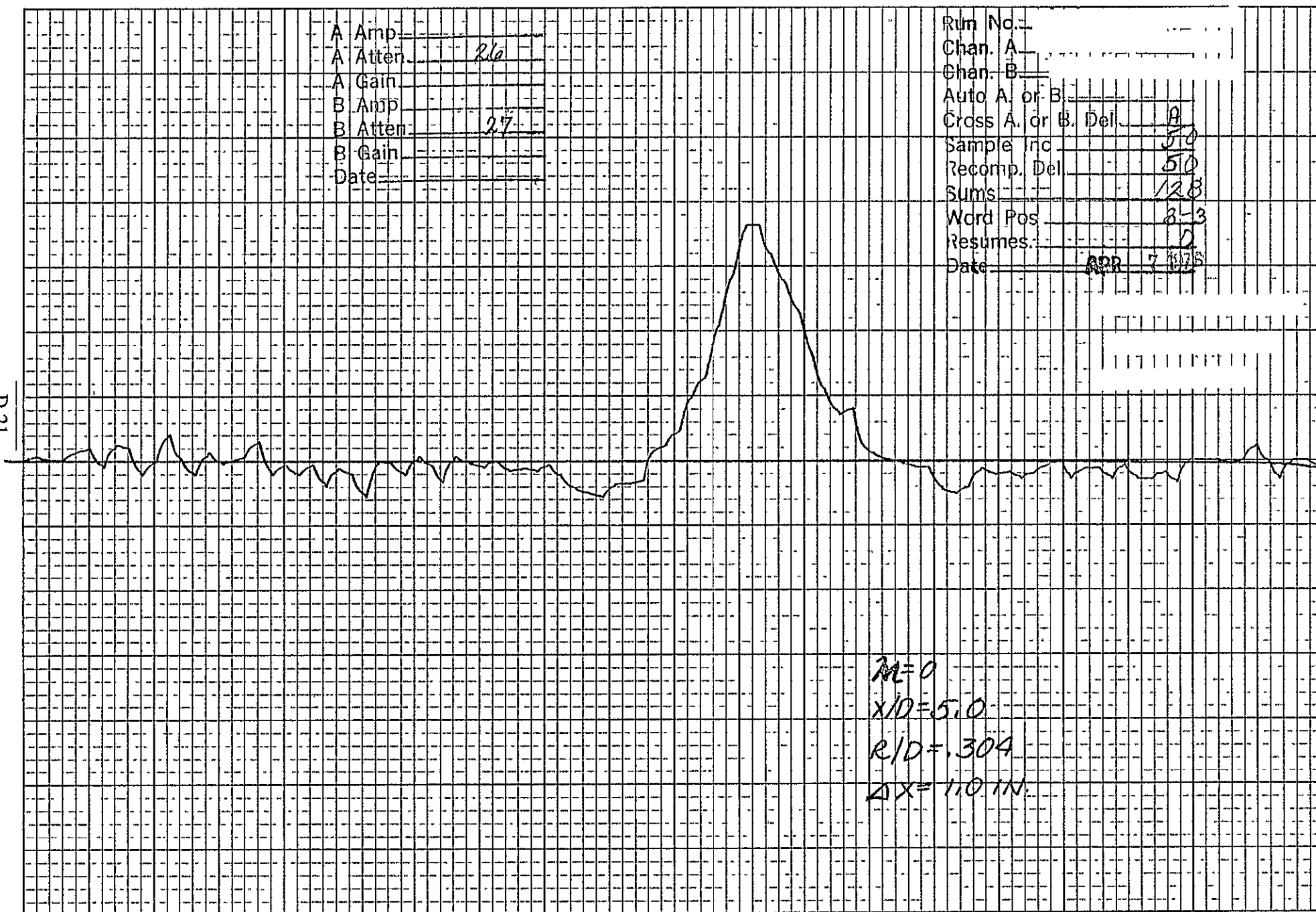
$M=0$
 $X/D=5.0$
 $R/D=.304$
 $\Delta X=1.0 \text{ IN.}$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp. _____
A Atten. 26
A Gain _____
B Amp _____
B Atten. 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. A
Sample Inc. 50
Recomp. Del. 50
Sums 128
Word Pos. 8-3
Resumes. 0
Date APR 7 1978

D-21

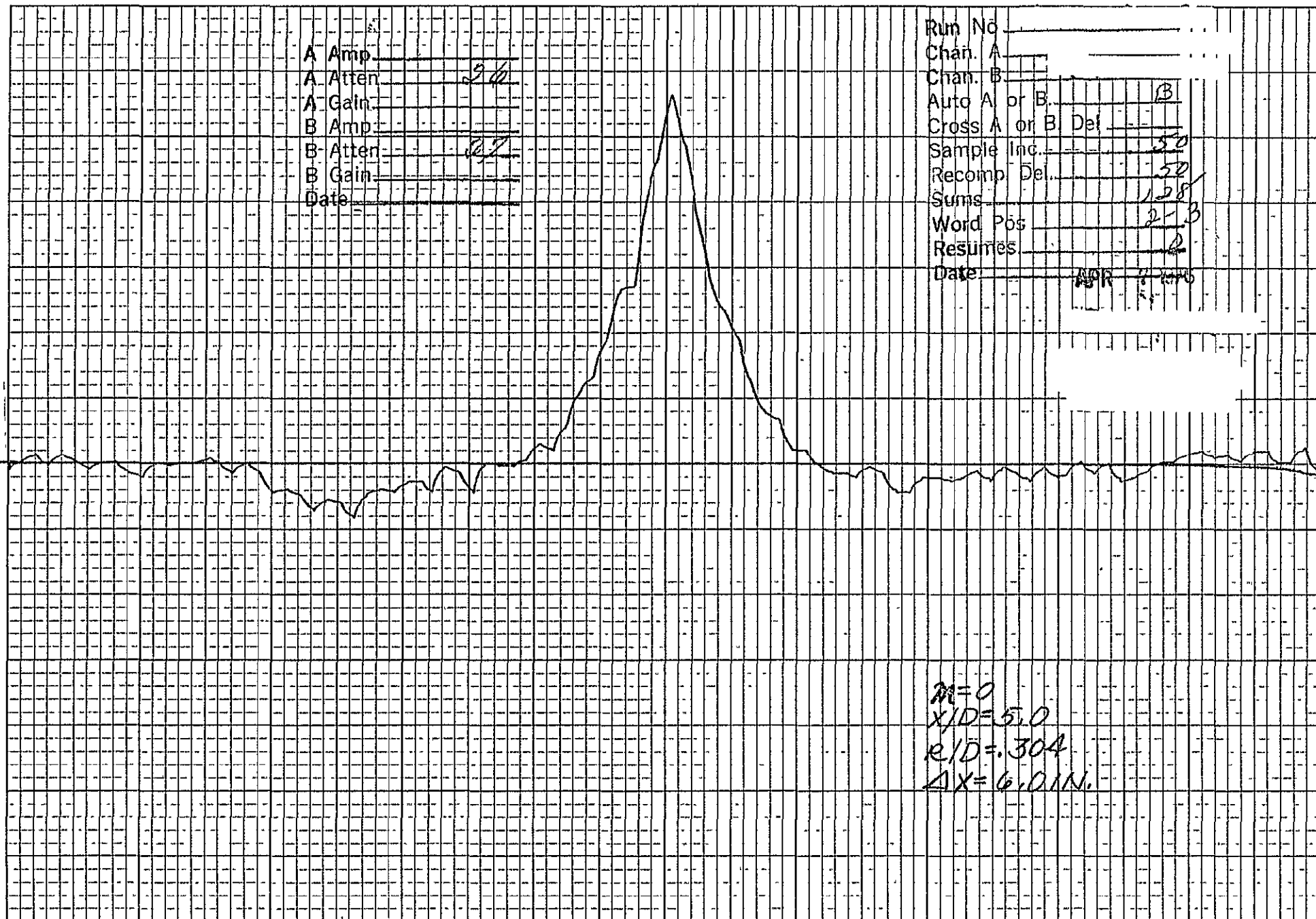


$M=0$
 $X/D=5.0$
 $R/D=.304$
 $\Delta X=1.0 IN.$

A Amp _____
A Atten 20
A Gain _____
B Amp _____
B Atten 20
B Gain _____
Date _____

Run No _____
Chan. A _____
Chan. B _____
Auto A or B B
Cross A or B Del _____
Sample Inc. 50
Recomp Del 50
Sums 128
Word Pos 2-3
Resumes 2
Date APR 4 1966

D-22



$M=0$
 $X/D=5.0$
 $R/D=.304$
 $\Delta X=6.01N.$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

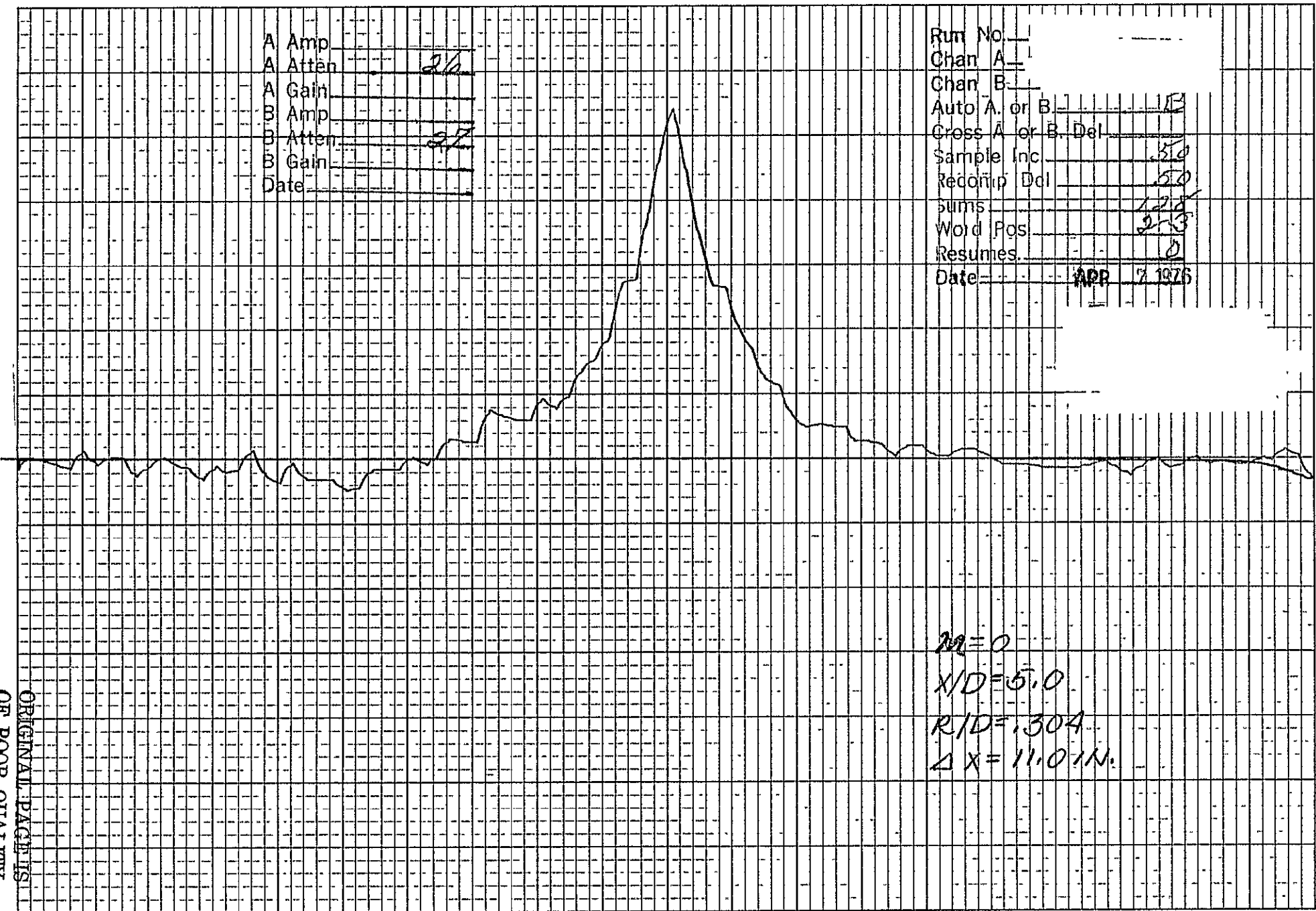
Run No. _____
Chan A _____
Chan B _____
Auto A or B _____
Cross A or Del A
Sample 50
Rect 0
Sum 128
Wt 2.4
Res 1
Date APR 7 1976

D-23

$M=0$
 $X/D=5.0$
 $R/D=.304$
 $\Delta X=16.0 \text{ IN.}$

A Amp
A Atten 24
A Gain
B Amp
B Atten 27
B Gain
Date

Run No.
Chan A
Chan B
Auto A. or B. 15
Cross A. or B. Del
Sample Inc. 5.0
Reconip Del 5.0
Sums 12.8
Word Pos 2.3
Resumes. 0
Date APR 7 1975



$M=0$
 $X/D=5.0$
 $R/D=1.304$
 $\Delta X=11.0 IN.$

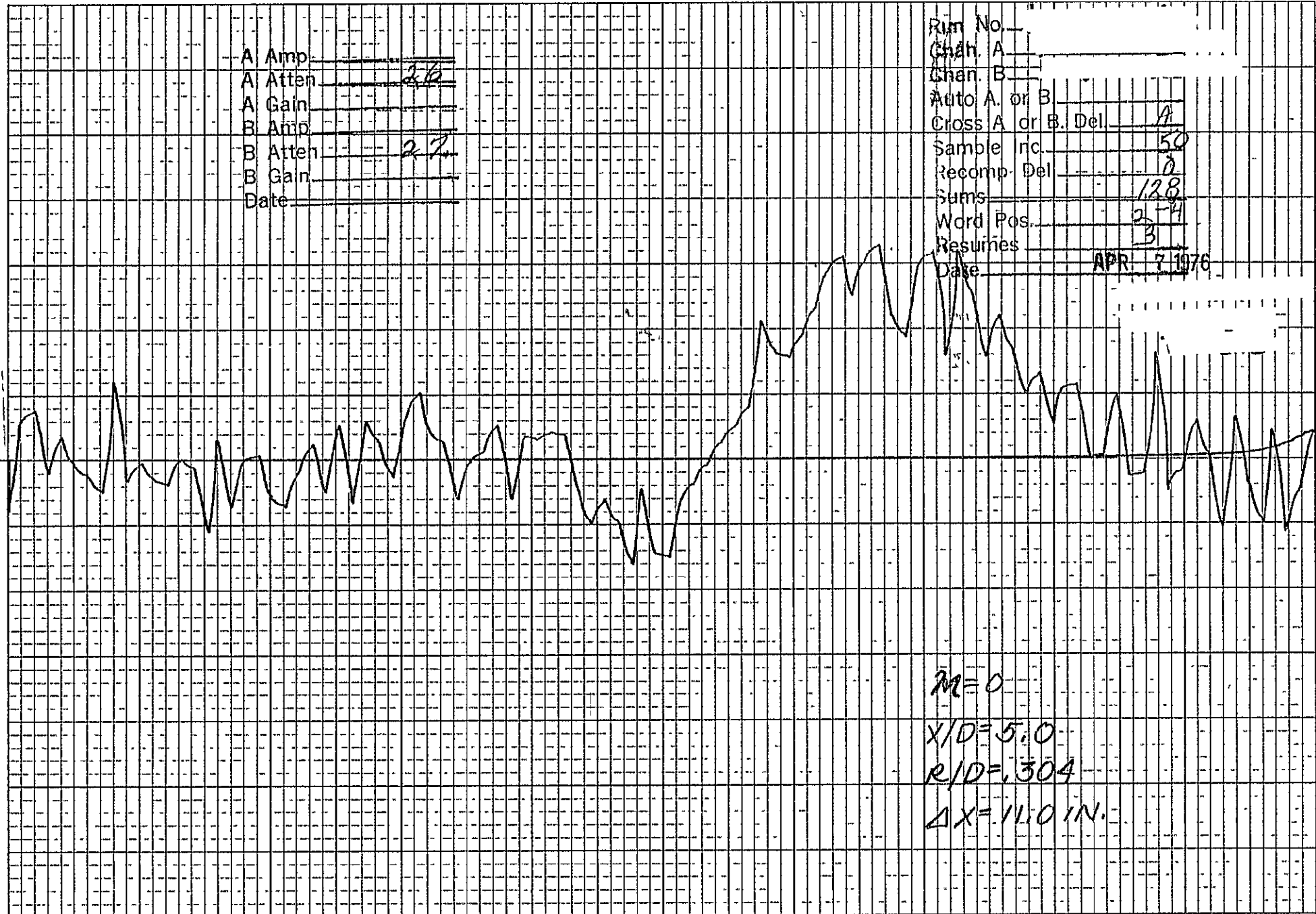
D-24

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 2.6
A Gain _____
B Amp _____
B Atten 2.7
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B _____
Cross A. or B. Del. A
Sample Inc. 50
Recomp. Del. 0
Sums 128
Word Pos. 2-4
Resumes 3
Date APR 7 1976

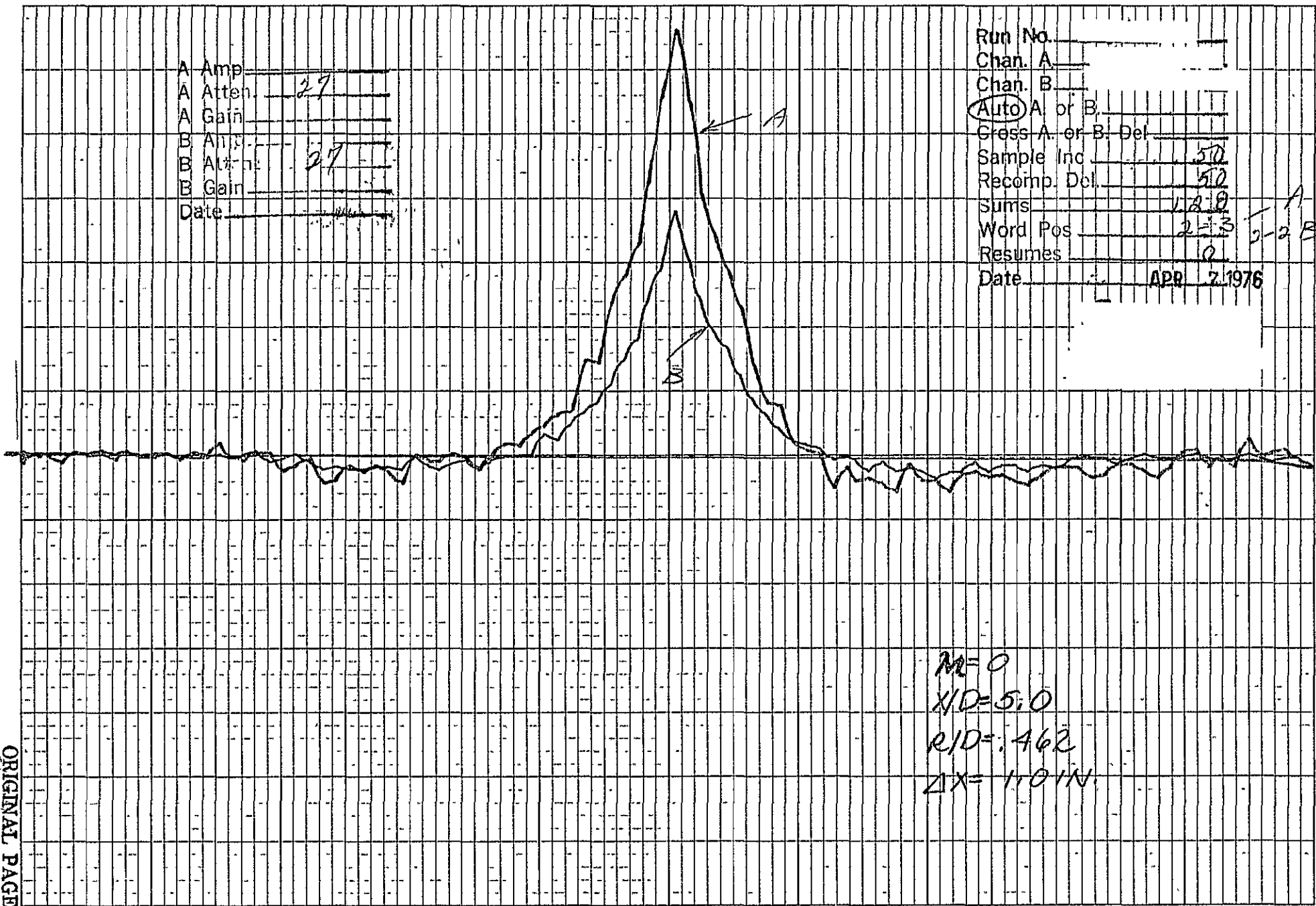
D-25



$M=0$
 $X/D=5.0$
 $R/D=.304$
 $\Delta X=11.0 \text{ IN.}$

A Amp _____
 A Atten. 27
 A Gain _____
 B Atten. _____
 B Gain _____
 Date _____

Run No. _____
 Chan. A _____
 Chan. B _____
 (Auto) A or B _____
 Gross A or B Del _____
 Sample Inc. 50
 Recomp. Del. 50
 Sums 1210
 Word Pos 2-3
 Resumes 0
 Date APR 2 1976



$M=0$
 $X/D=5.0$
 $R/D=.462$
 $\Delta X=11.0 IN.$

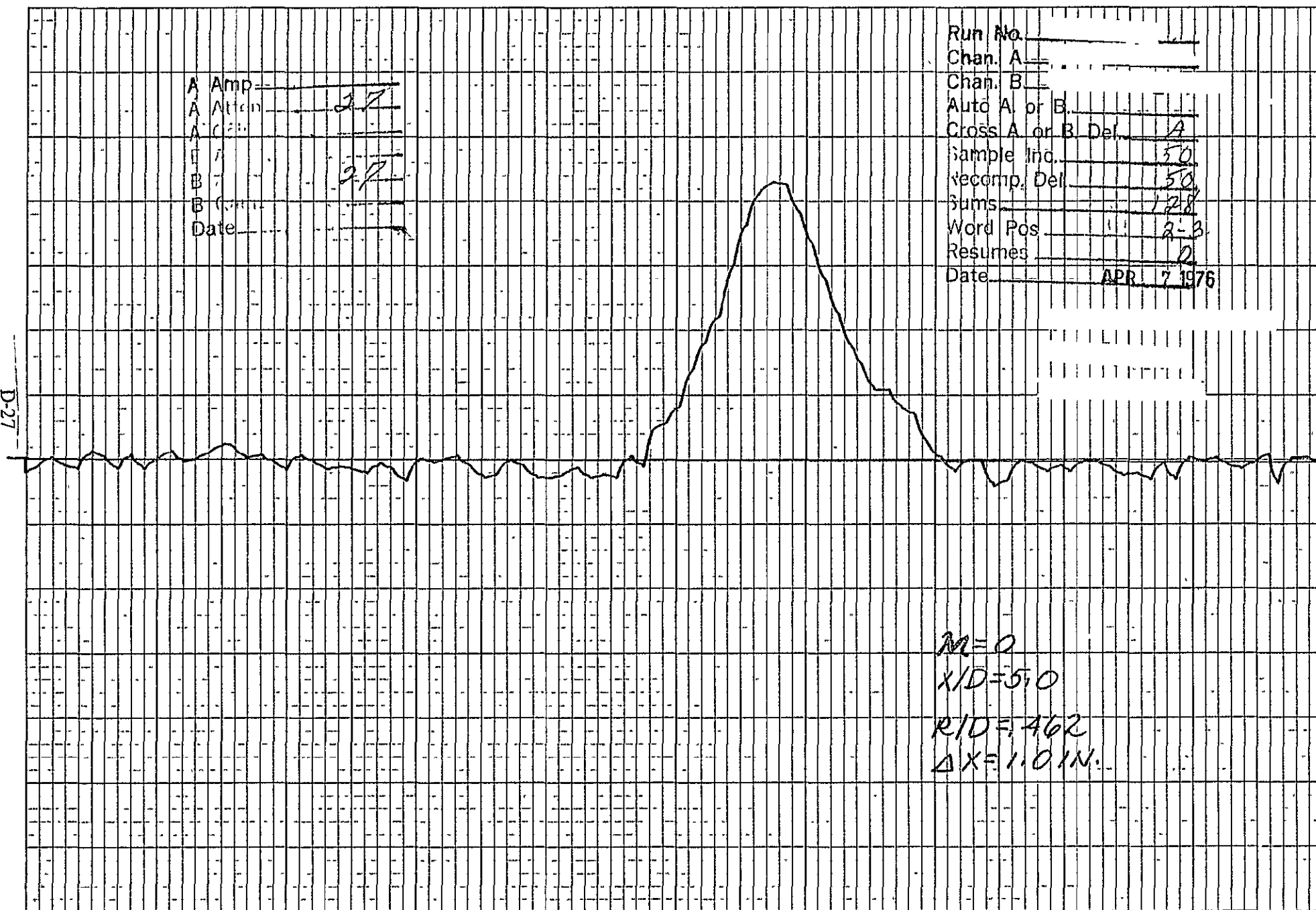
D-26

ORIGINAL PAGE IS
 OF POOR QUALITY

A Amp 27
A Atten 27
A C.F. 27
B 27
B C.F. 27
Date APR 7 1976

Run No. 1
Chan. A 1
Chan. B 1
Auto A. or B. 1
Cross A. or B. Del. A
Sample Inc. 50
Recomp. Del. 50
Sums 128
Word Pos 2-3
Resumes 0
Date APR 7 1976

D-27



M=0
X/D=5.0
R/D=462
 $\Delta X=1.0 \text{ IN.}$

A Amp
A Atten 27
A Gain
B Amp
B Atten 27
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A. or B. B
Cross A. or B. Del.
Sample Inc. 50
Lockup Del. 50
Sum. 12.8
Word Pos. 8-2
Resumes 0
Date APR 7 1978

D-28

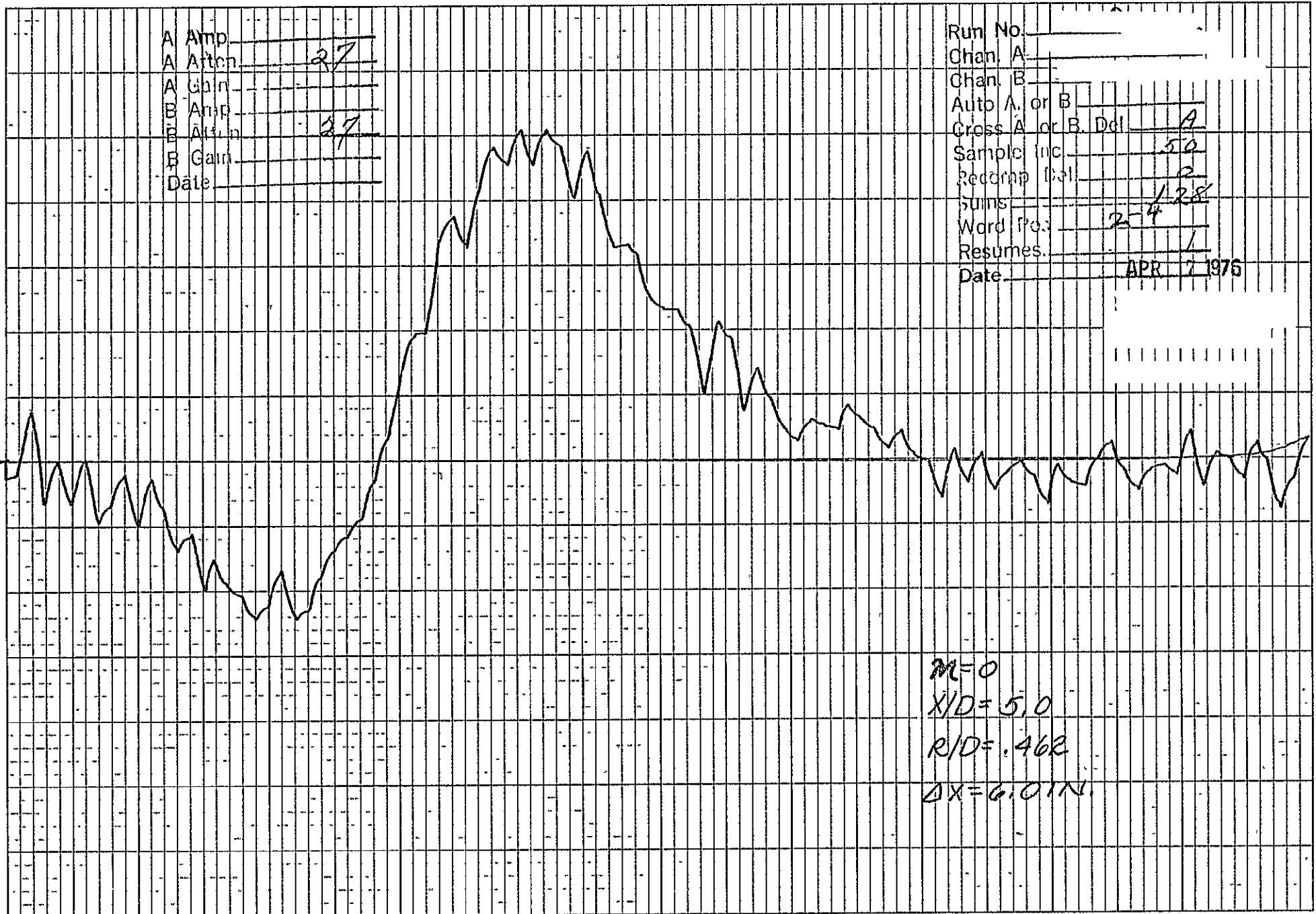
$M=0$
 $X/D=5.0$
 $R/D=.462$
 $\Delta X=6.0 \text{ IN.}$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B _____
Cross A. or B. Del A
Sample Inc. 50
Recamp Del 2
Sums 128
Word Pos 2-4
Resumes 1
Date APR 7 1976

D-29



$M=0$
 $X/D=5.0$
 $R/D=.462$
 $\Delta X=6.01N.$

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. B
Cross A or B Del. _____
Sample No. 50
Record el. 50
Sum 12.8
Word 2-3
Resumes 0
Date APR 7 1976

D-30

$M = 0$
 $X/D = 5.0$
 $R/D = .462$
 $\Delta X = 11.0 \text{ IN.}$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B. Del. A
Sample c 50
Reco. 0
Sum 120
Wrt. 2-1
Resumes 3
Date Apr 7 1976

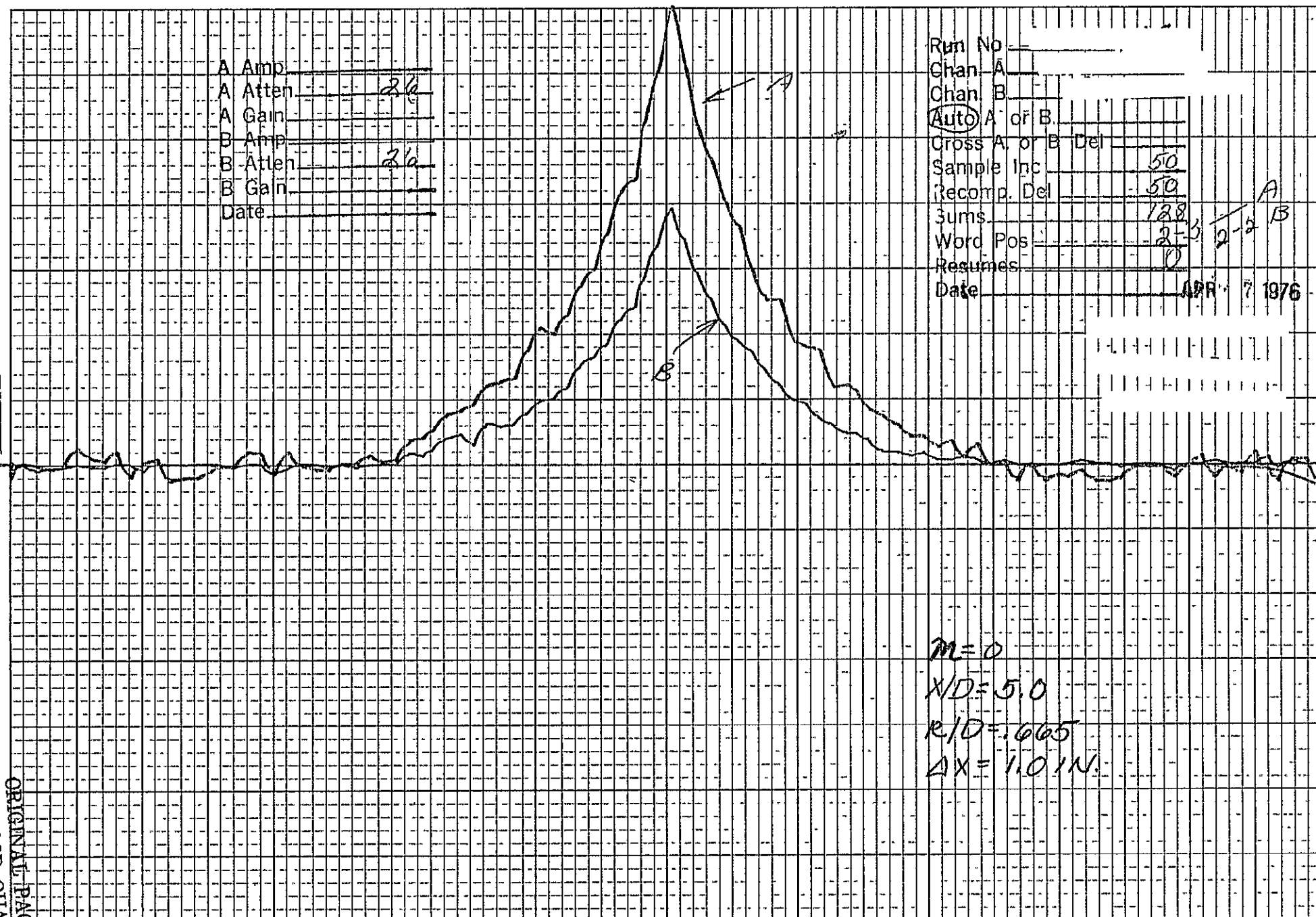
D-31

~~M~~ = 0
X/D = 5.0
R/D = .462
 $\Delta X = 11.0 \text{ IN.}$

A Amp _____
 A Atten 2 1/2
 A Gain _____
 B Amp _____
 B Atten 2 1/2
 B Gain _____
 Date _____

Run No _____
 Chan A _____
 Chan B _____
 (Auto) A or B _____
 Cross A or B Del _____
 Sample Inc 50
 Recomp. Del 50
 Sums 128
 Word Pos 2-3 2-2 13
 Resumes 0
 Date APR 7 1976

D-32

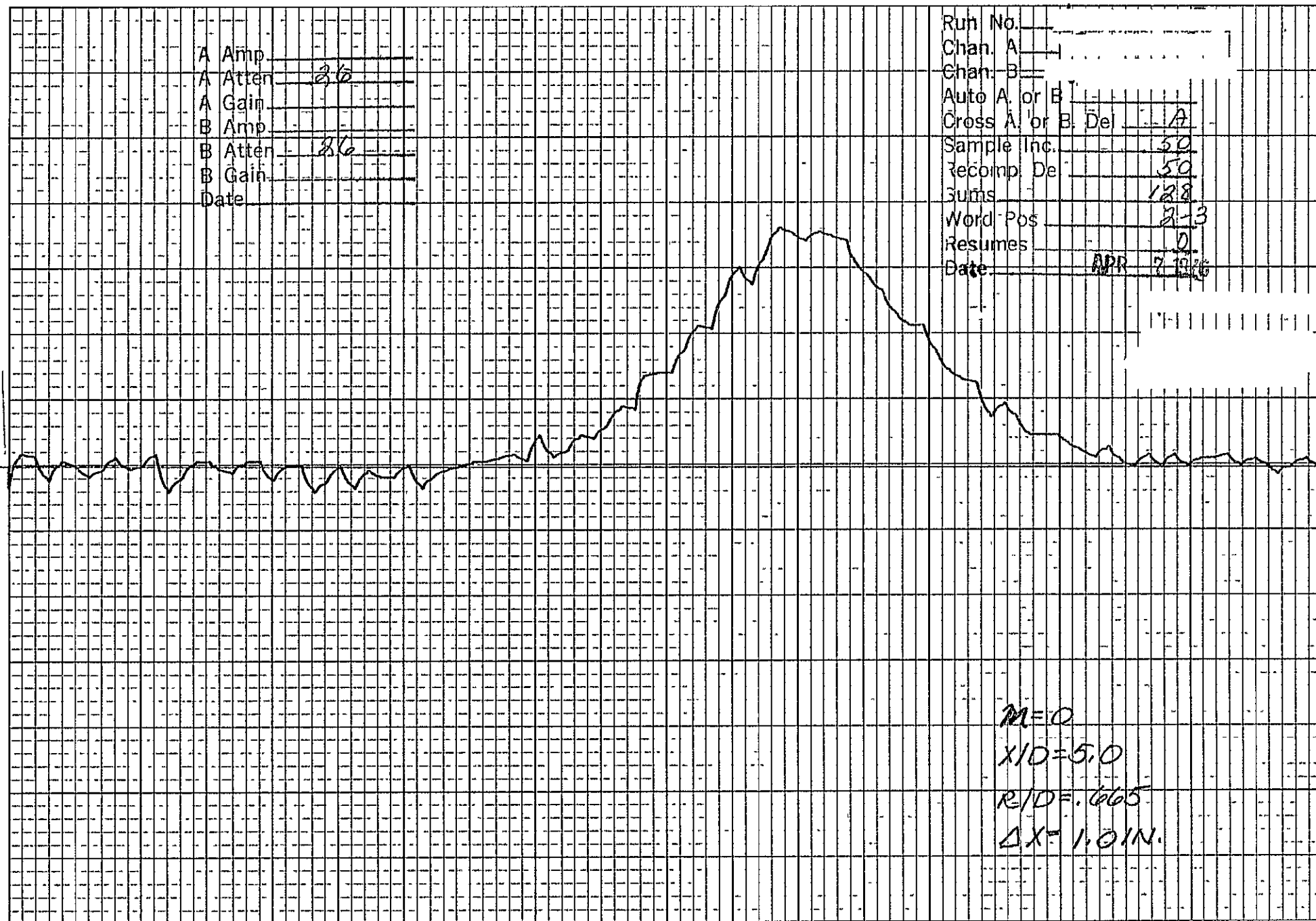


$M=0$
 $X/D=5.0$
 $R/D=.665$
 $\Delta X=1.01N$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

Run No. _____
Chan. A 1
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del A
Sample Inc. 50
Recomp. De 50
Sums 128
Word Pos 2-3
Resumes 0
Date APR 7 1966

D-33

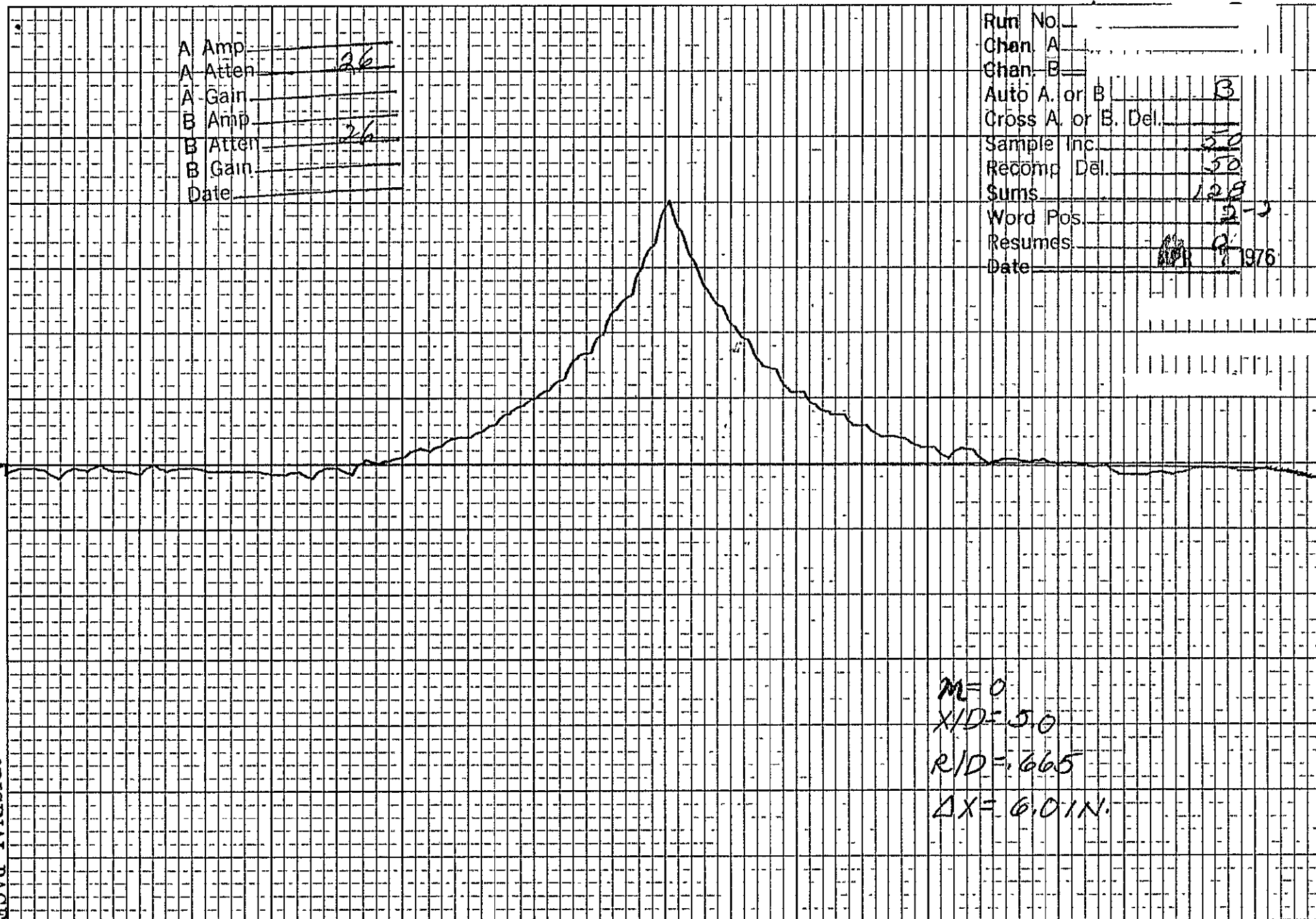


$M=0$
 $X/D=5.0$
 $R/D=.665$
 $\Delta X=1.01N.$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. B
Cross A. or B. Del. _____
Sample Inc. 50
Recomp Del. 50
Sums 128
Word Pos. 2-3
Resumes. 9
Date APR 9 1976

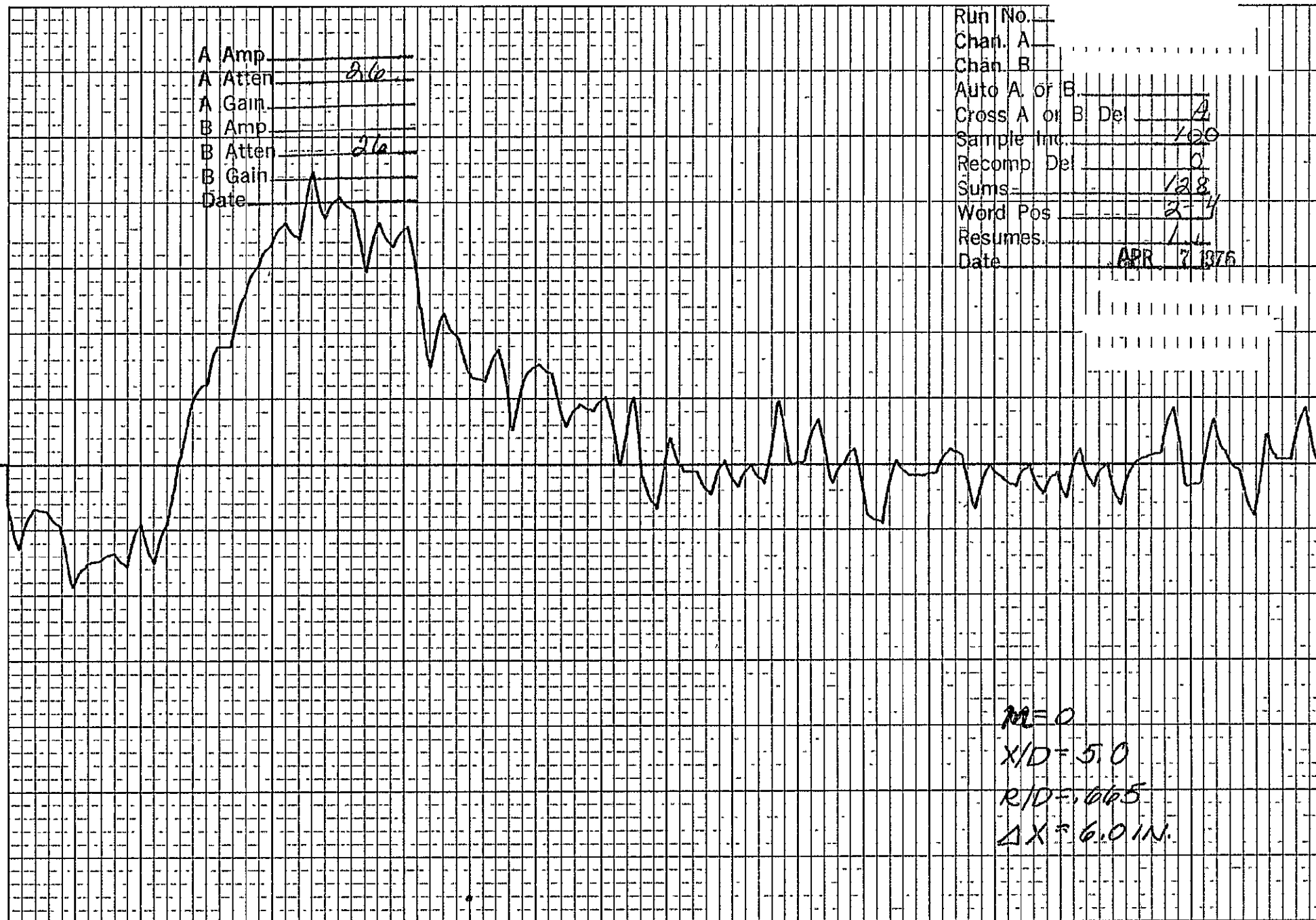
D-34



$M=0$
 $X/D=5.0$
 $R/D=665$
 $\Delta X=6.01N.$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

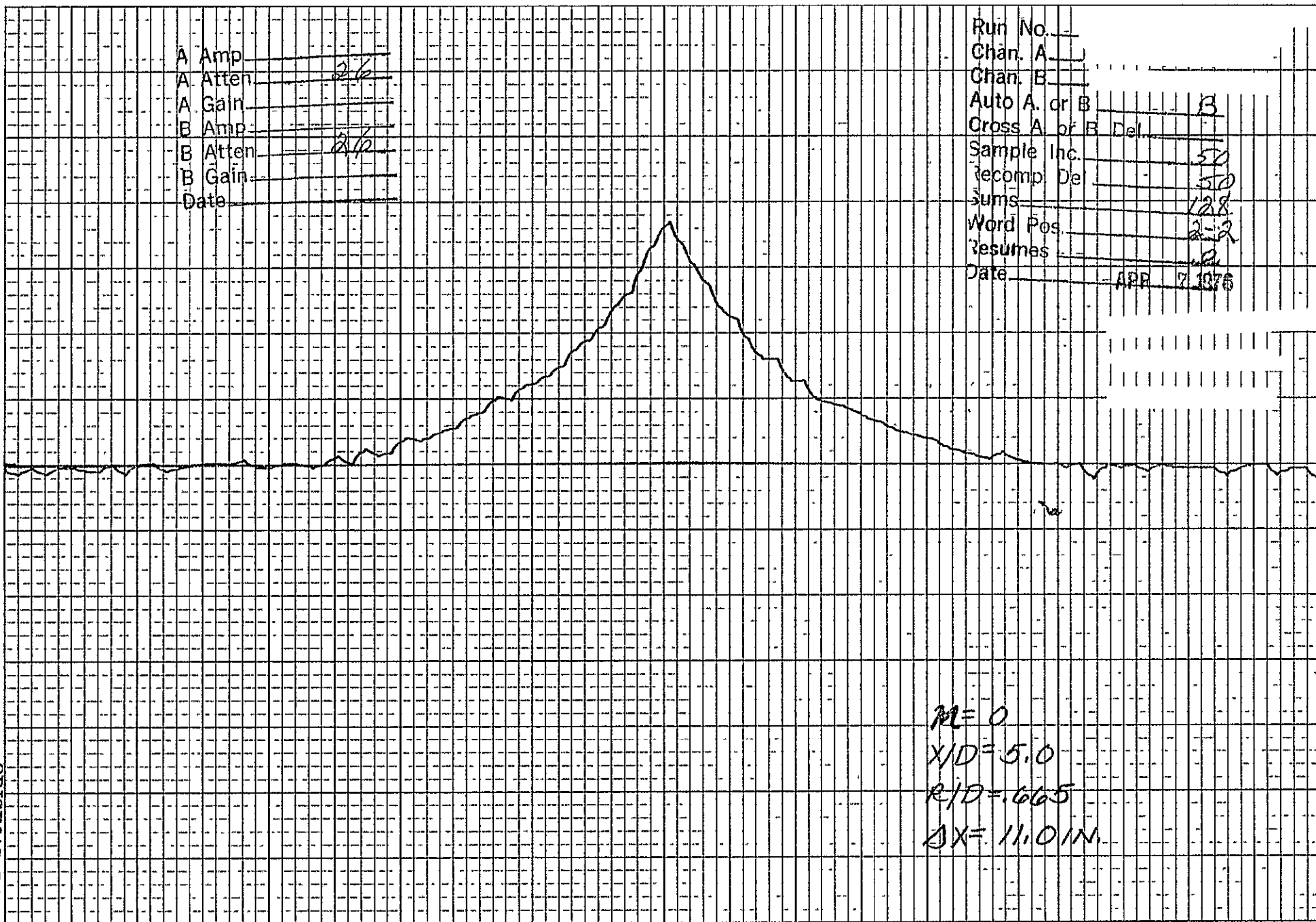
Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A or B Del 4
Sample Inc. 100
Recomp Del 0
Sums 128
Word Pos 2-4
Resumes 1-4
Date APR 7 1976



$M=0$
 $X/D=5.0$
 $R/D=0.65$
 $\Delta X=6.0 \text{ IN.}$

A Amp _____
A Atten 2.6
A Gain _____
B Amp _____
B Atten 2.6
B Gain _____
Date _____

Run No. _____
Chan. A
Chan. B
Auto A. or B
Cross A. or B Del.
Sample Inc. 50
Recomp Del. 50
Sums 128
Word Pos. 2-2
Resumes
Date APR 7 1976

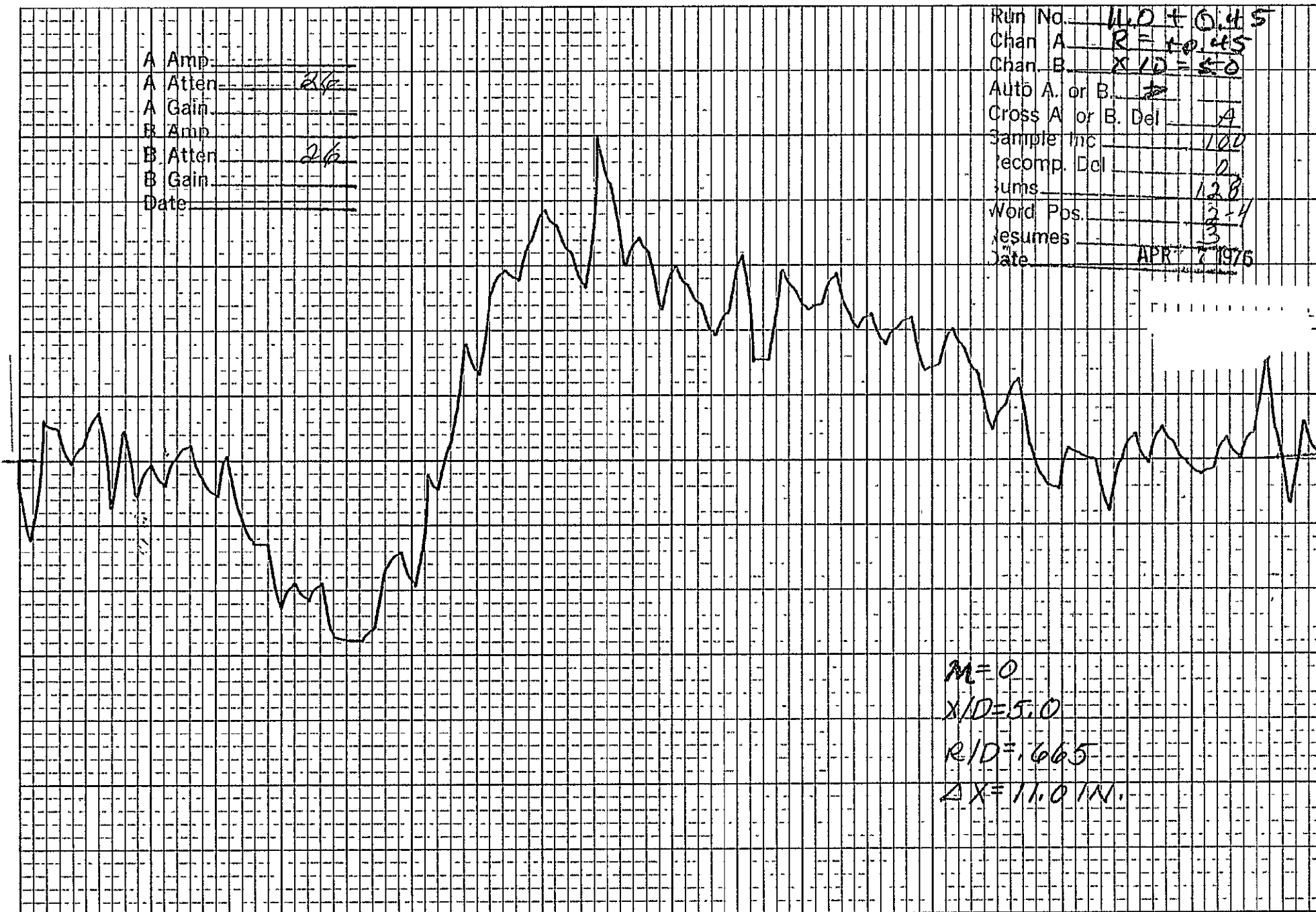


$M = 0$
 $X/D = 5.0$
 $R/D = 665$
 $\Delta X = 11.0 \text{ IN.}$

A Amp. _____
A Atten. 26
A Gain. _____
B Amp. _____
B Atten. 26
B Gain. _____
Date _____

Run No. 11.0 + 0.45
Chan A R = 10.45
Chan B X/D = 5.0
Auto A. or B. A
Cross A. or B. Del. A
Sample Inc. 100
Recomp. Del. 2
Sums 128
Word Pos. 3-4
Resumes 3
Date APR 7 1975

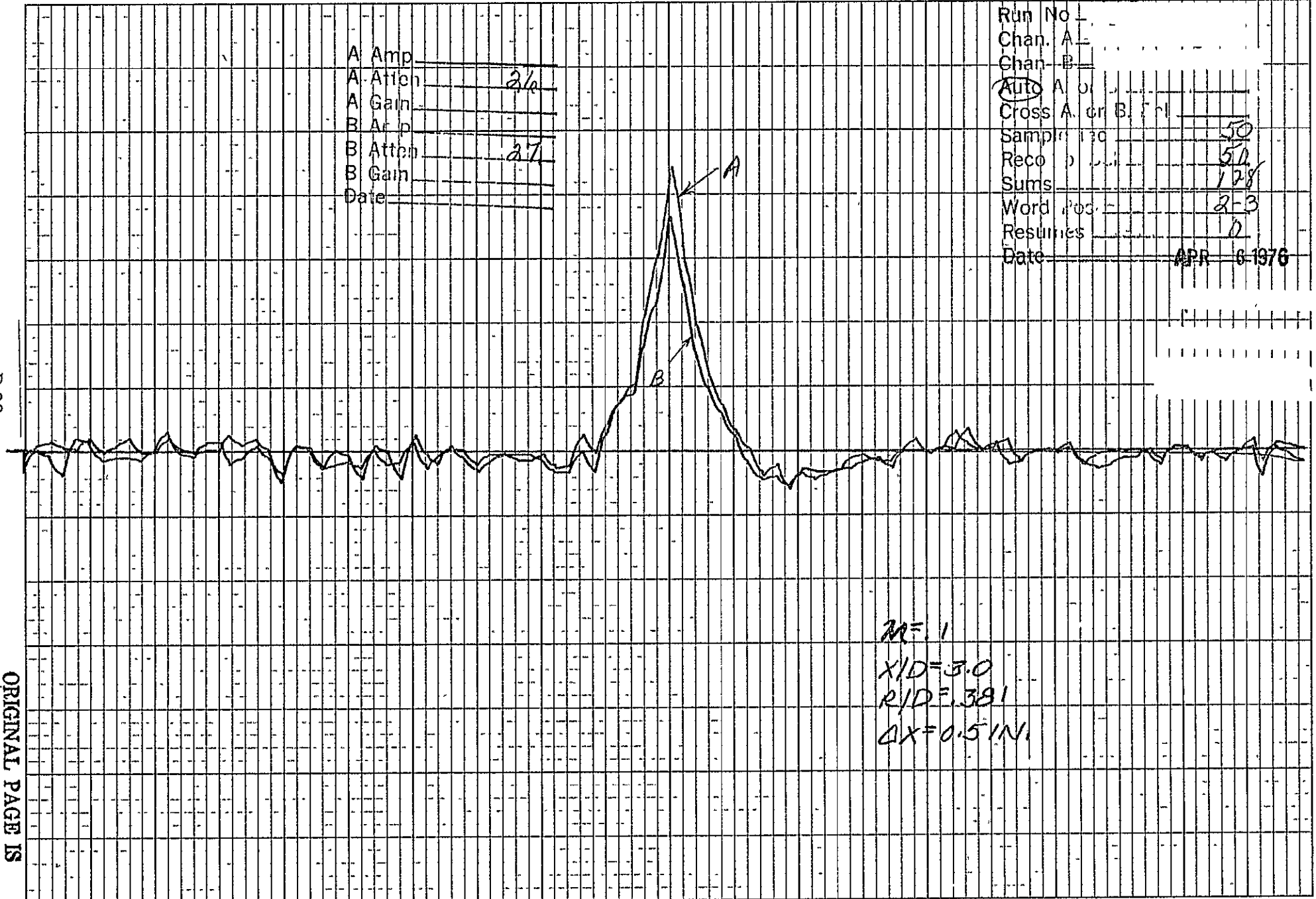
D-37



$M=0$
 $X/D=5.0$
 $R/D=1.665$
 $\Delta X=11.0 IN.$

A Amp
A Atten 2/6
A Gain
B Amp
B Atten 2/7
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A or B
Cross A. or B.
Sample 50
Reco 50
Sums 128
Word 2-3
Resumes 0
Date APR 6 1976

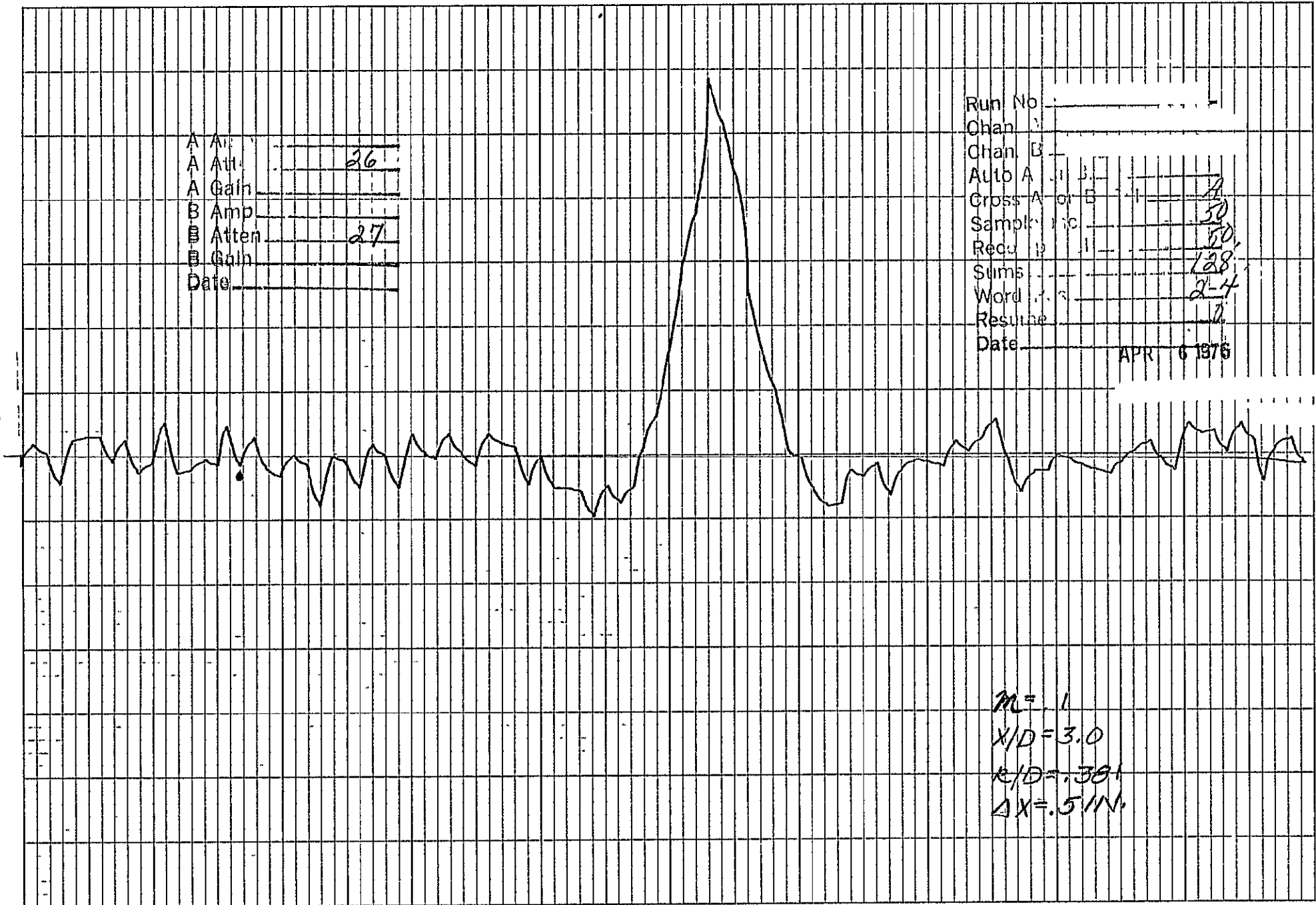


$M=1$
 $X/D=3.0$
 $R/D=.381$
 $\Delta X=0.51N$

A Amp _____
A Att. 26
A Gain _____
B Amp _____
B Atten. 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A ☒ ☐
Cross A or B ☒ ☐
Sample Rate 50
Recu. p. 50
Sums 128
Word 2-4
Resume 2
Date APR 6 1976

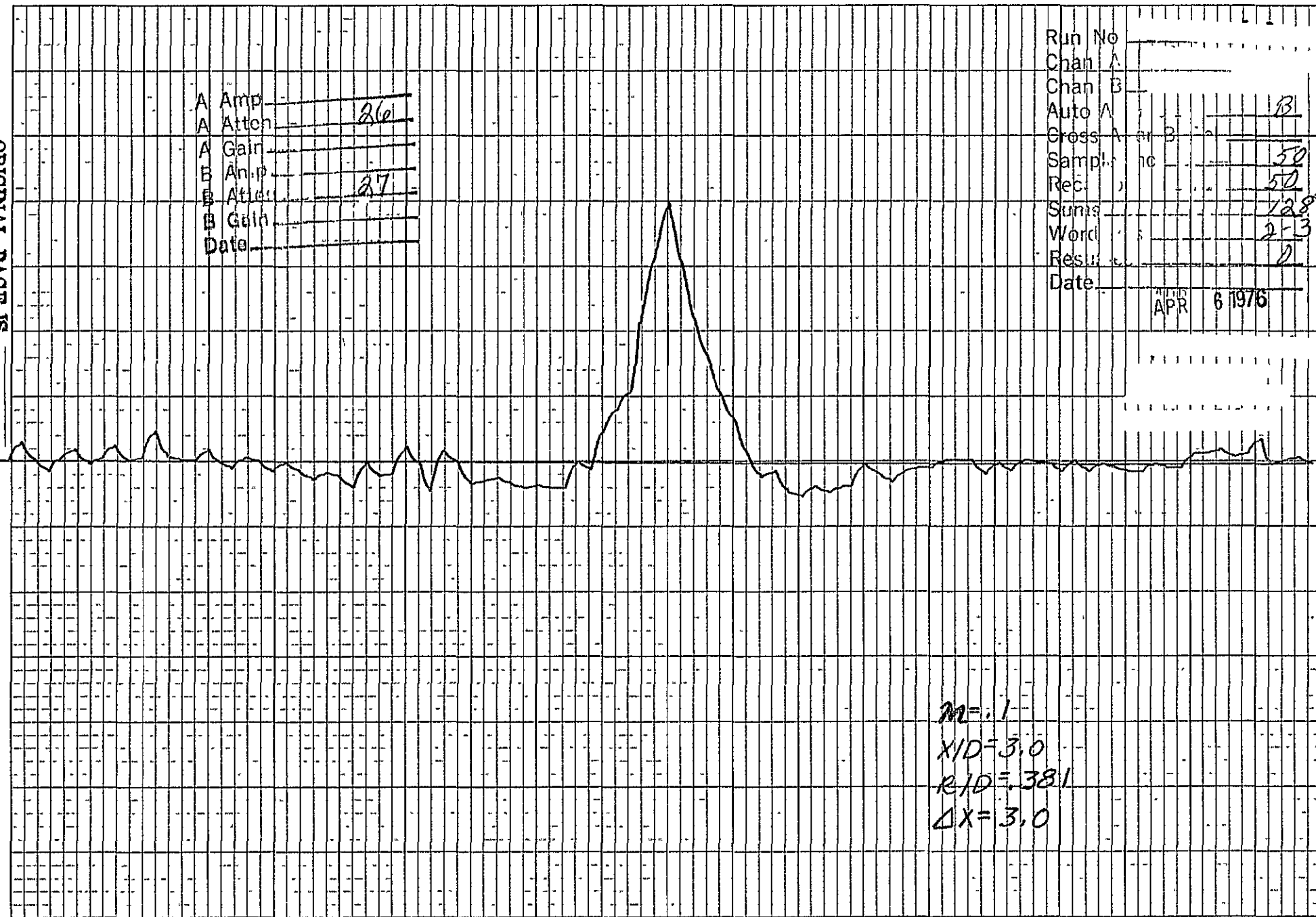
D-39



$m = 1$
 $X/D = 3.0$
 $R/D = .381$
 $\Delta X = .5/W$

A Amp. 26
A Atten. 27
A Gain 27
B Amp. 27
B Atten. 27
B Gain 27
Date

Run No.
Chan. A
Chan. B
Auto A
Cross A or B
Sample No. 50
Rec. 50
Sum 128
Word 253
Res. 0
Date APR 6 1976



$m = 1$
 $X/D = 3.0$
 $R/D = 381$
 $\Delta X = 3.0$

ORIGINAL PAGE IS
OF POOR QUALITY

D-40

PRECEDING PAGE BLANK NOT FILMED

A Amp _____
A Att. 26
A Gain _____
B Amp _____
B Att. 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A. or B Del. A
Sample Inc. 50
Recomp. Del. 50
Sums 128
Word Pos. 2-5
Resumes 0
Date APR 6 1976

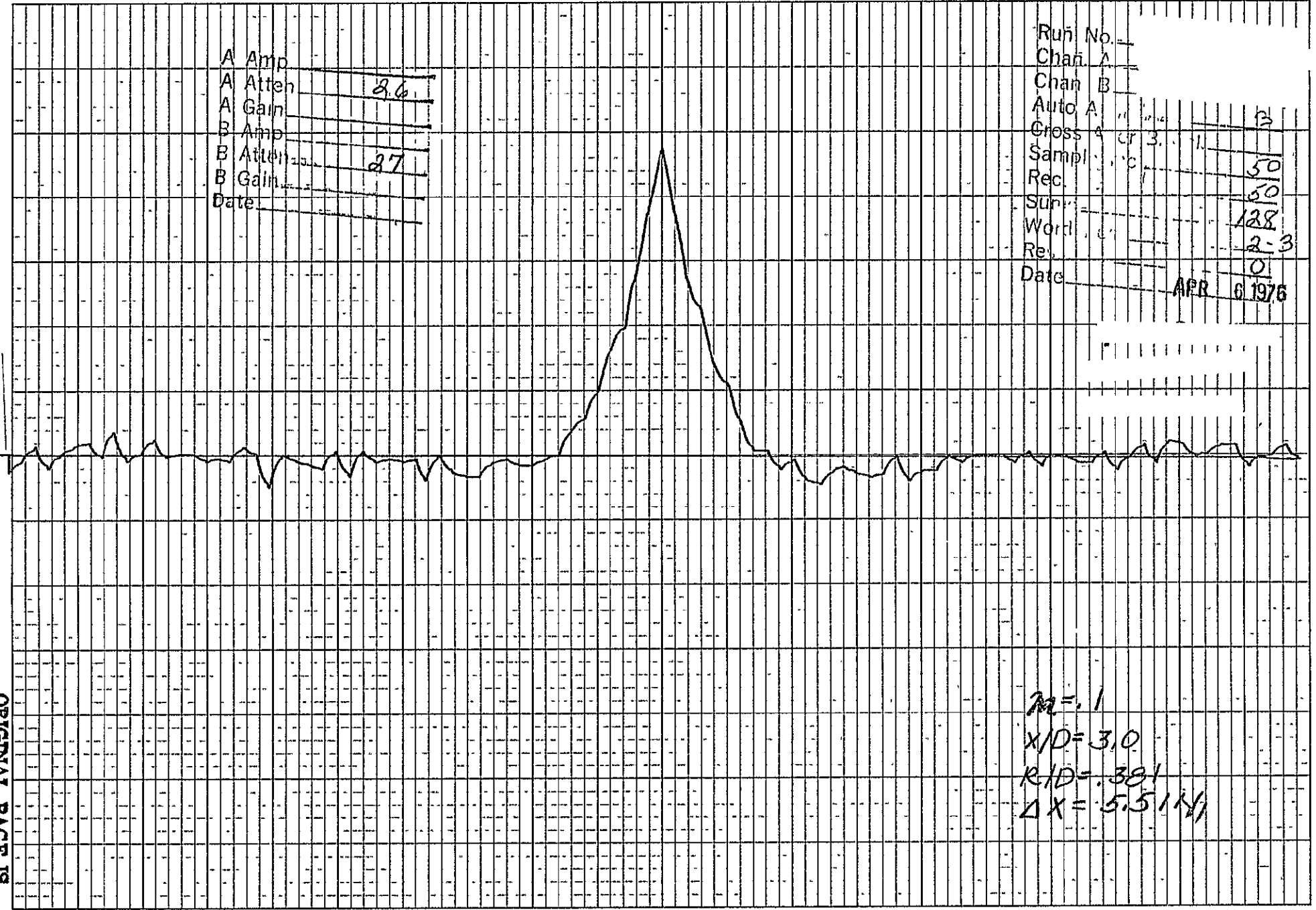
D41

$M = 1$
 $X/D = 3.0$
 $R/D = .381$
 $\Delta X = 3.0 \text{ IN.}$

A Amp
A Atten 26
A Gain
B Amp
B Atten 27
B Gain
Date

Run No.
Chan A
Chan B
Auto A
Cross A Cr 3.1
Sampl. 50
Rec. 60
Surf. 128
Word 2-3
Re.
Date APR 6 1976

D42



$M = .1$
 $X/D = 3.0$
 $R/D = .381$
 $\Delta X = 5.51 \mu$

ORIGINAL PAGE IS
OF POOR QUALITY

Run No.	
Chan. A	
Chan. B	
Auto A or B	
Cross A. or B Del.	A
Sample Inc.	50
Reconip Del	0
Sums	128
Word Pos.	2-5
Resumes	1
Date	APR 6 1976

$$\begin{aligned} M &= 1 \\ X/D &= 3.0 \\ R/D &= .381 \\ \Delta X &= 5.51 \text{ N} \end{aligned}$$

D-43

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp
A Atten 27
A Gain
B Atten 27
B Gain
Date

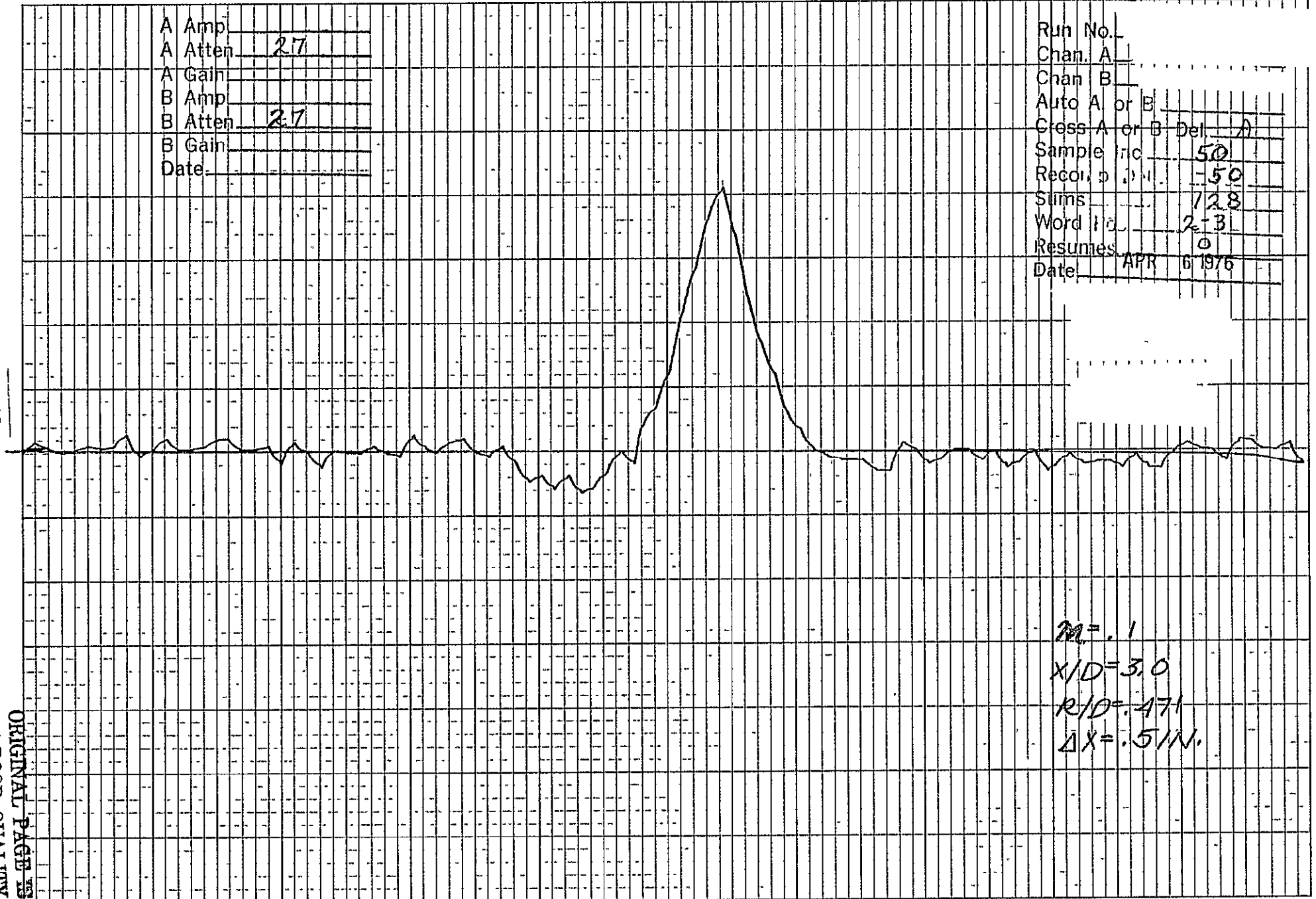
Run No 0.5
Chan A R = 0.0
Chan B X/D = 3.0
Auto A. or B
Cross A or B Del
Sample Inc 20
Recon p fcl -50
Sums 128
Word Pos 2-9
Resumes 0
Date APR 5 1976

D-44

M = 1
X/D = 3.0
R/D = 471
 $\Delta X = .5 IN.$

A Amp _____
A Atten 2.7
A Gain _____
B Amp _____
B Atten 2.7
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del. A
Sample No. 50
Record No. 50
Slits 12.8
Word No. 2-3
Resumes 0
Date APR 6 1976



$M = .1$
 $X/D = 3.0$
 $R/D = .471$
 $\Delta X = .5/N.$

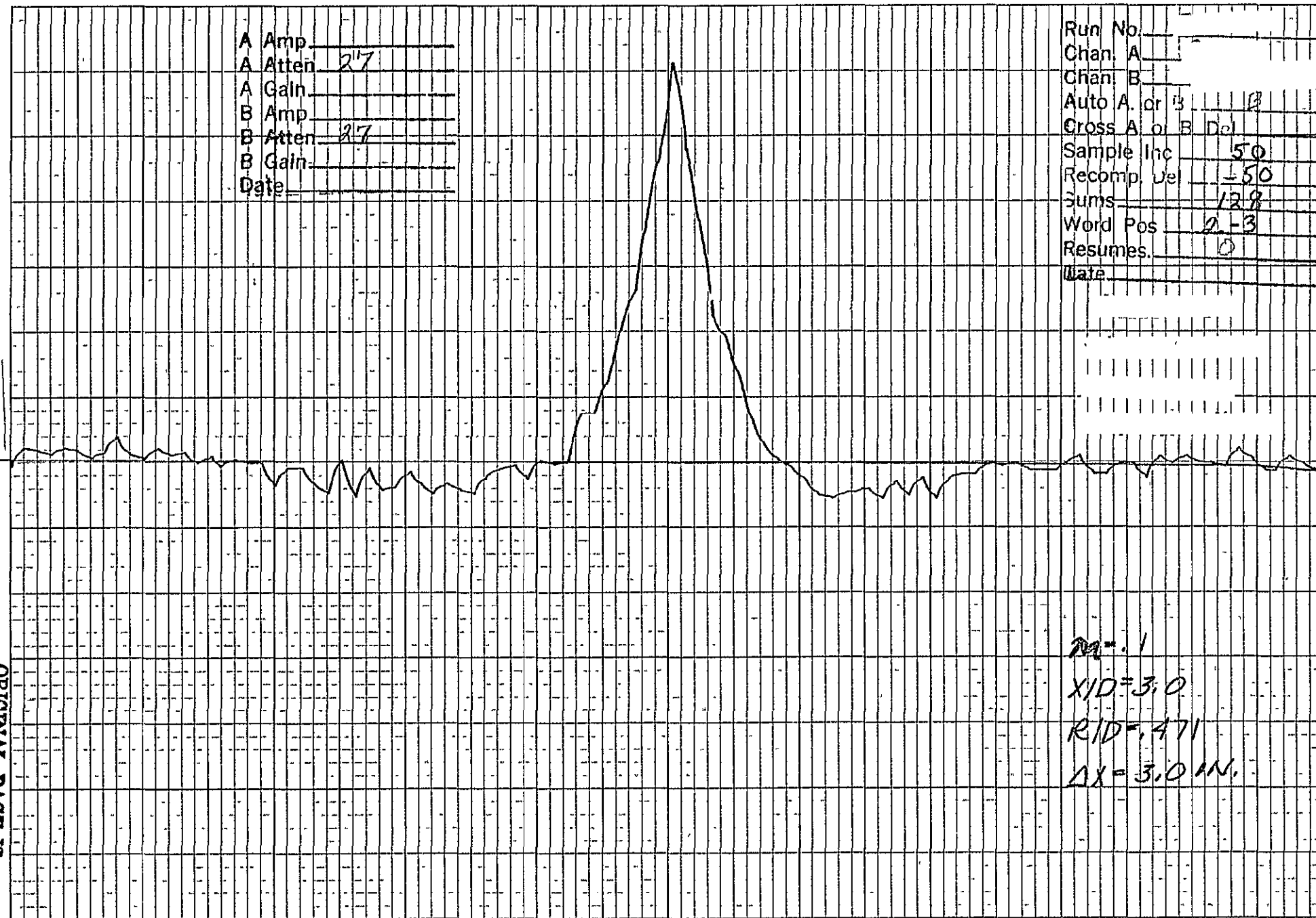
D-45

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. B
Cross A. or B. Del. _____
Sample Inc. 50
Recomp. Vel. 50
Sums 128
Word Pos. 2-3
Resumes. 0
Date _____

D-46



$M = .1$
 $X/D = 3.0$
 $R/D = .471$
 $\Delta X = 3.0 \text{ IN.}$

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

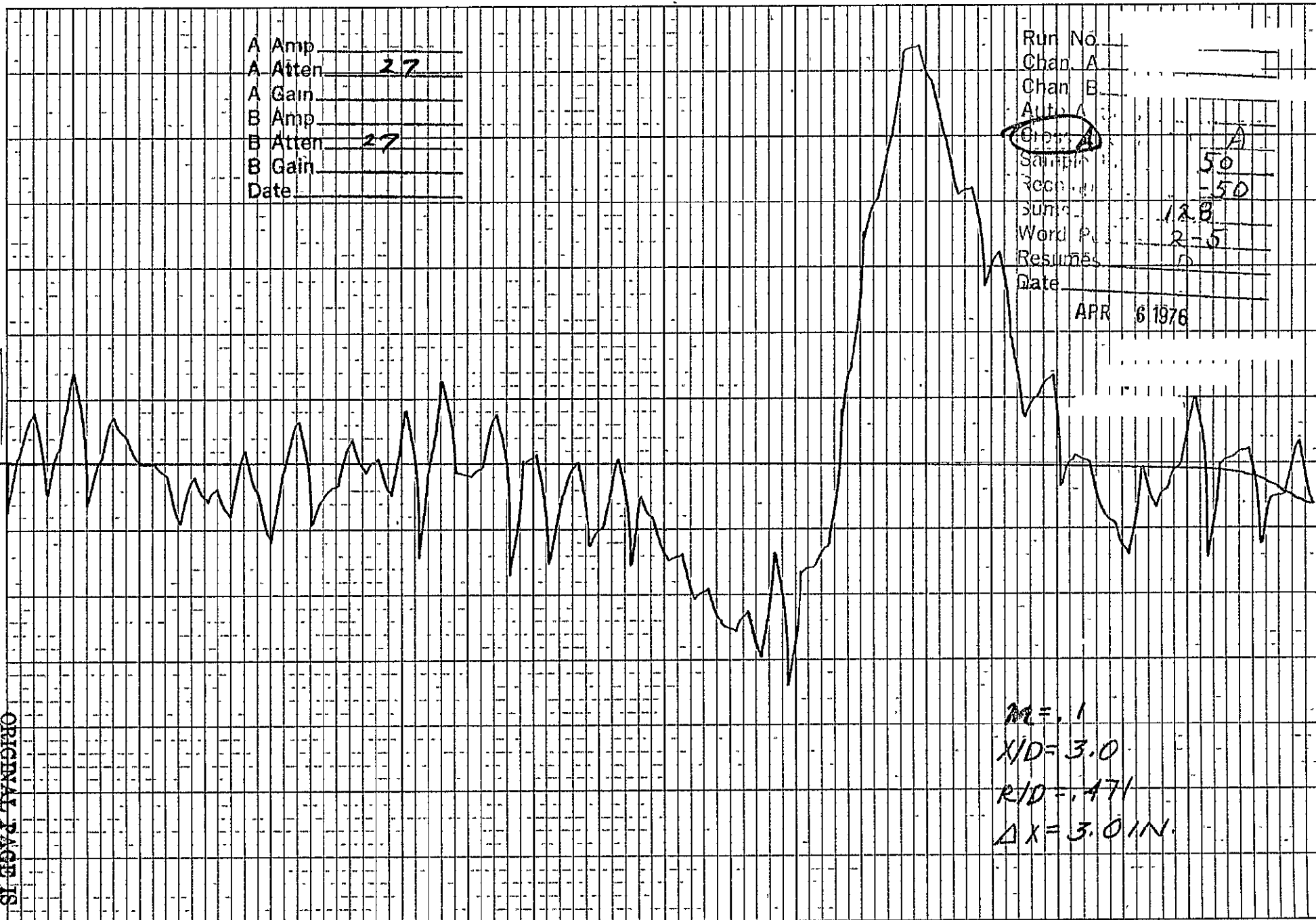
Run No _____
Chan A _____
Chan B _____
Auto A _____
Grp A _____
Sample _____
Recd _____
Sum _____
Word P _____
Resumes _____
Date _____

APR 6 1976

D-47

ORIGINAL PAGE IS
OF POOR QUALITY

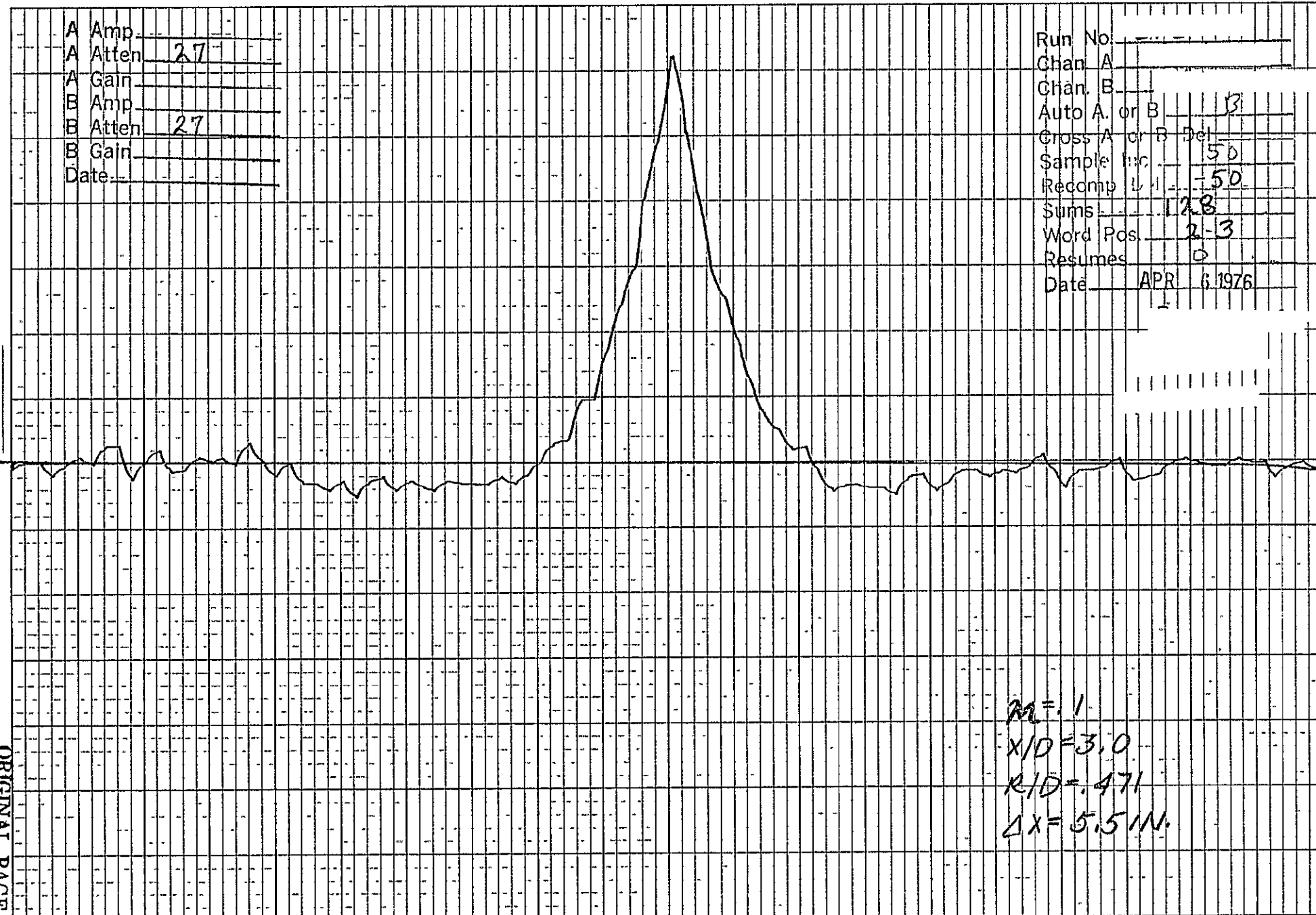
$M = .1$
 $X/D = 3.0$
 $R/D = .471$
 $\Delta X = 3.0 \text{ IN.}$



A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. B
Cross A. or B. Del. _____
Sample Inc. 50
Recomp. L. 50
Sums 128
Word Pos. 2-3
Resumes 0
Date APR 6 1976

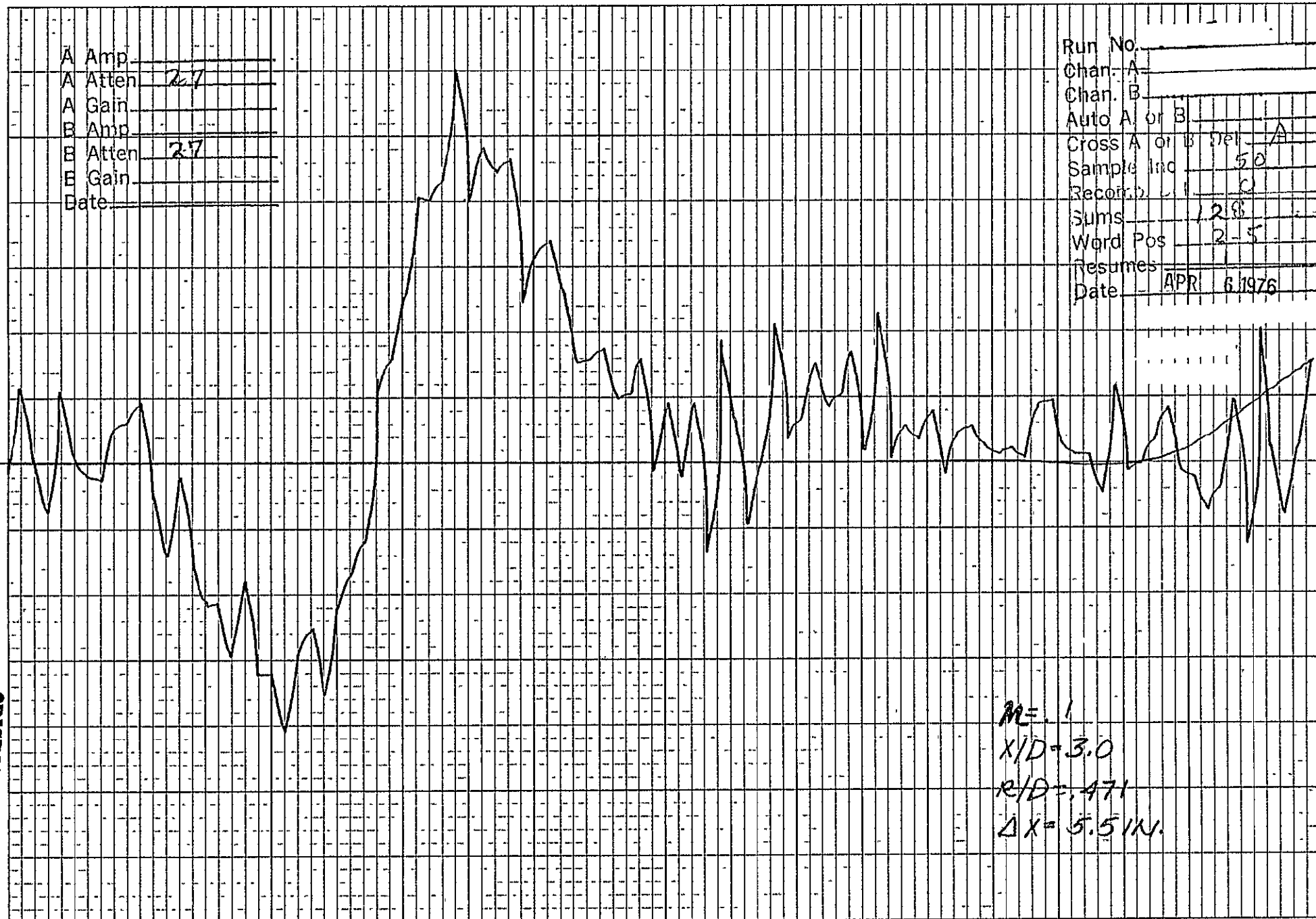
D-48



$M = 1$
 $X/D = 3.0$
 $R/D = .471$
 $\Delta x = 5.5 \text{ IN.}$

A Amp _____
A Atten 2.7
A Gain _____
B Amp _____
B Atten 2.7
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Sel A
Sample Inc 50
Record 2
Sums 128
Word Pos 2-5
Resumes _____
Date APR 6 1976

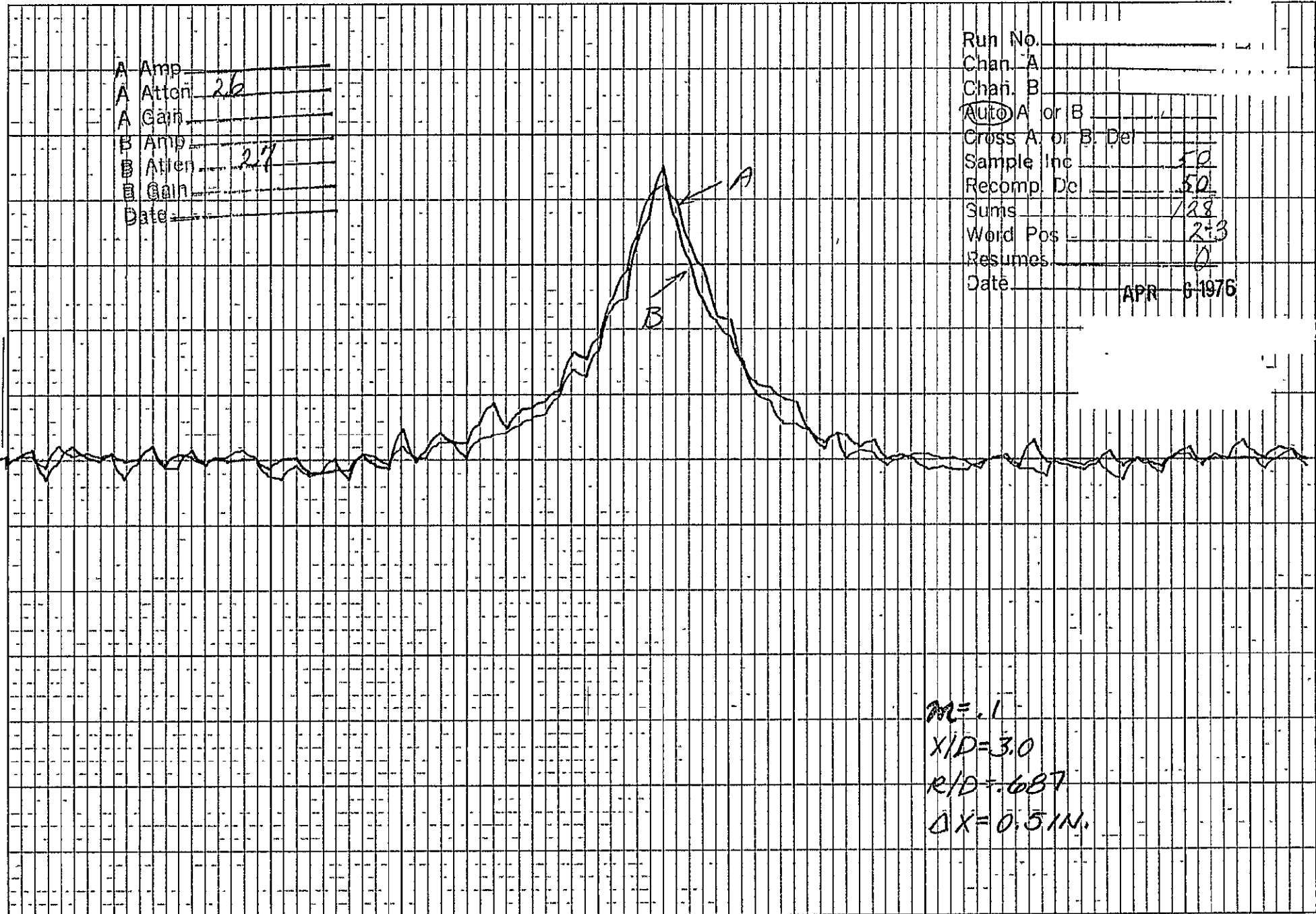


$M = 1$
 $X/D = 3.0$
 $R/D = .471$
 $\Delta X = 5.5 IN.$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B. Del _____
Sample Inc 50
Recomp. Del 50
Sums 128
Word Pos 23
Resumes 0
Date APR 6 1976

D-50



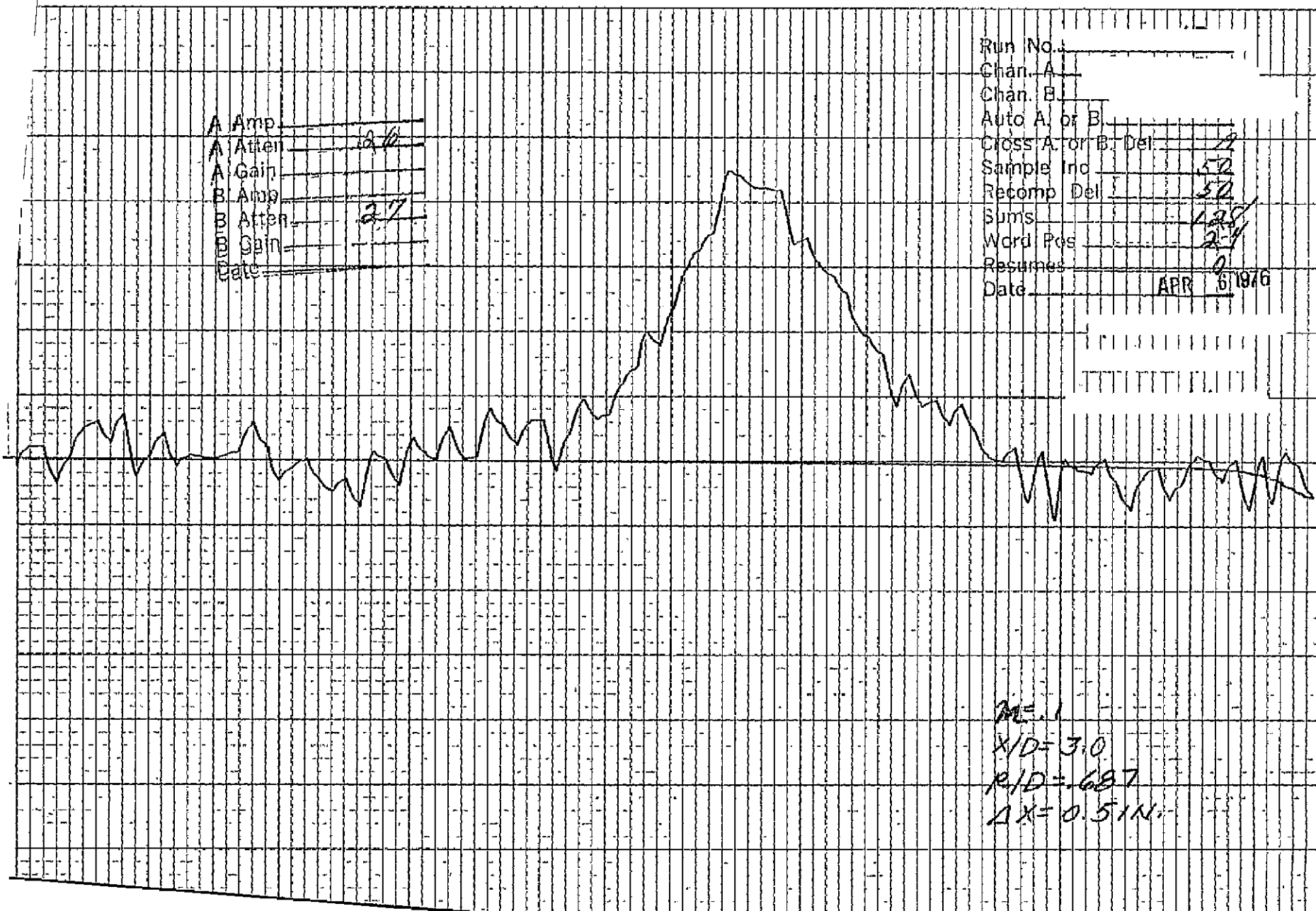
$M = .1$
 $X/D = 3.0$
 $R/D = .687$
 $\Delta X = 0.51N.$

RECORDING CHARTS
GRAPHIC CONTROLS CORPORATION
BUFFALO, NEW YORK
PRINTED IN U.S.A.

NO XY-1001 - SP 1

A Amp _____
A Atten 2.6
A Gain _____
B Amp _____
B Atten 2.7
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. 2
Sample Inc. 50
Recomp Del. 50
Sums 128
Word Pos 2-1
Resumes 0
Date APR 6 1976

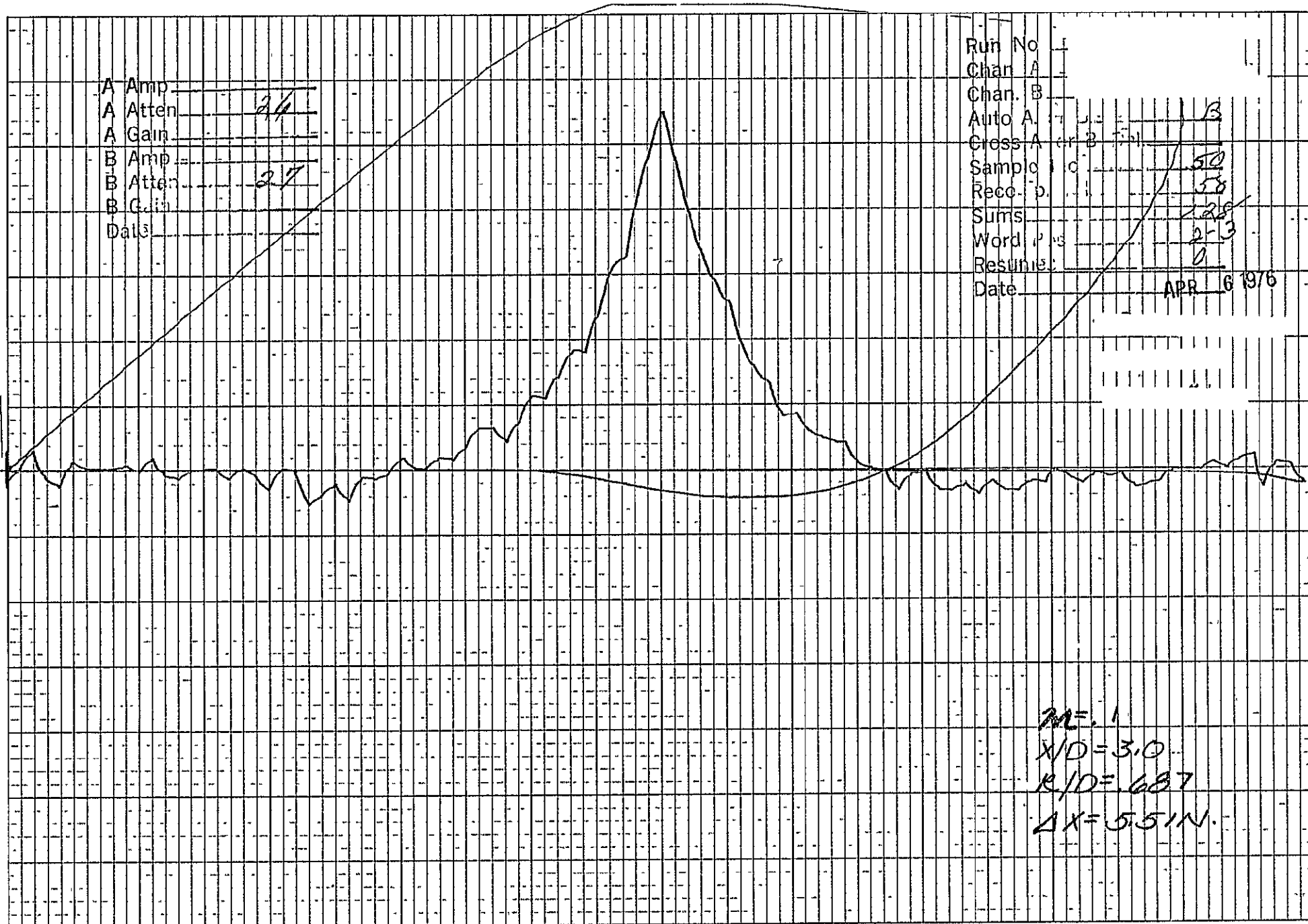


ME. 1
X/D = 3.0
R/D = 687
ΔX = 0.5 IN.

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 24
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

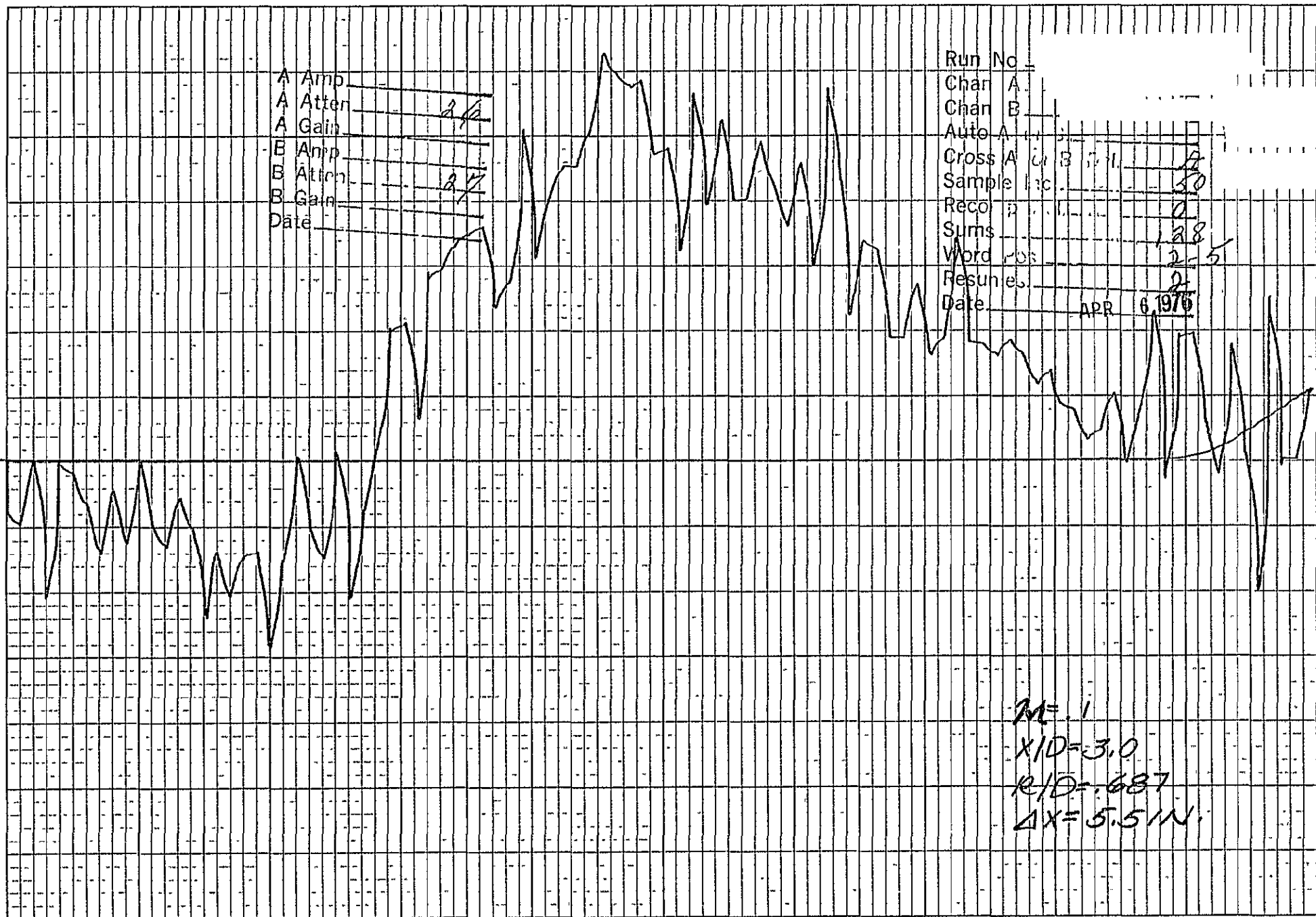
Run No _____
Chan A _____
Chan B _____
Auto A B
Cross A or B 1
Sample C 50
Reco. 58
Sums 228
Word 2-3
Resum. 0
Date APR 6 1976



$\mu = 1$
 $X/D = 3.0$
 $R/D = 687$
 $\Delta X = 5.51N$

A Amp _____
A Atten _____ 2.5
A Gain _____
B Amp _____
B Atten _____ 2.5
B Gain _____
Date _____

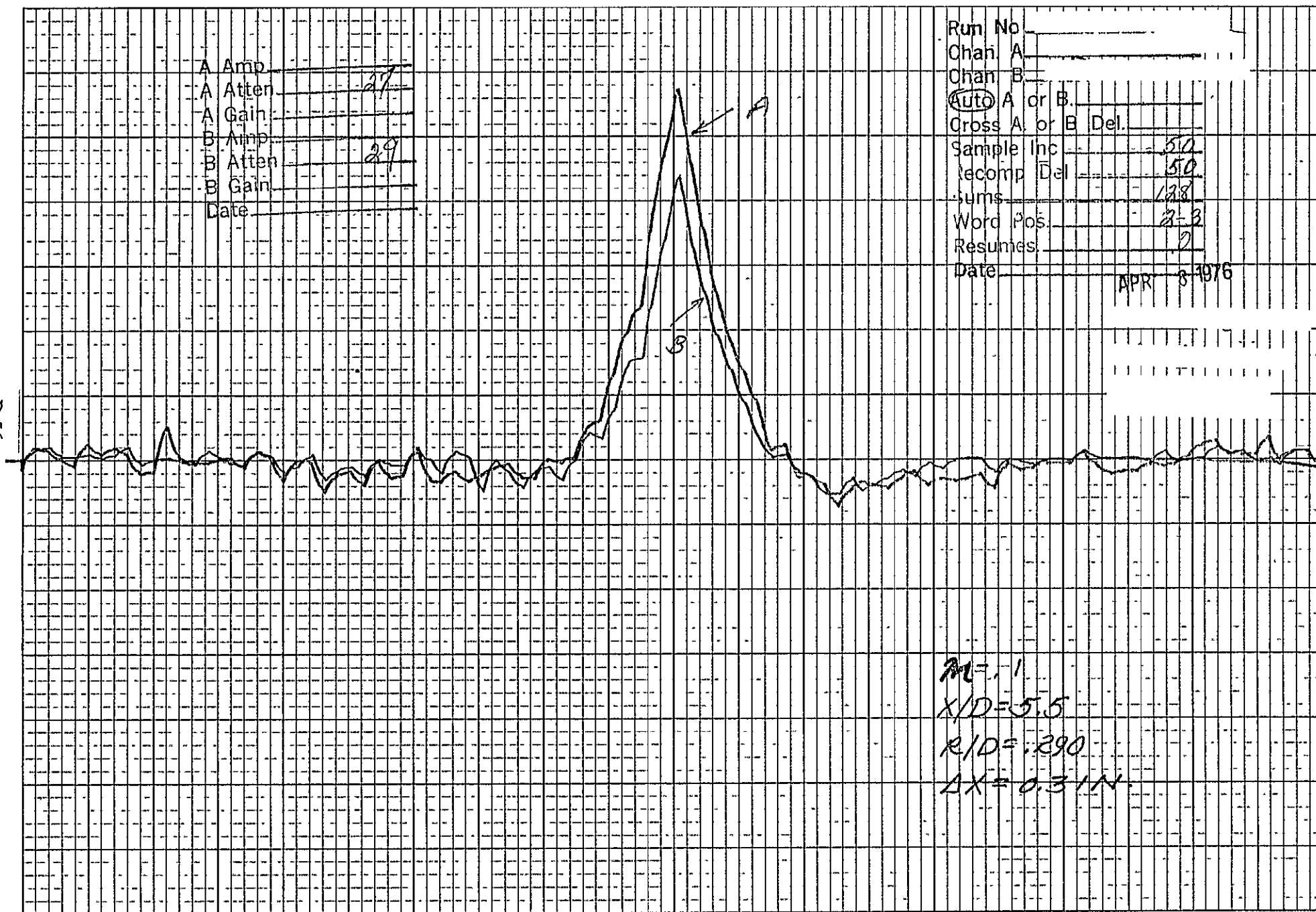
Run No. _____
Char. A. _____
Char. B. _____
Auto A. _____
Cross A. & B. _____
Sample Inc. _____ 30
Reco. p. _____
Sums _____ 128
Word pos. _____ 2-5
Resumes. _____
Date _____ APR 6 1976



$M = .1$
 $X/D = 3.0$
 $R/D = .687$
 $\Delta X = 5.5 IN.$

A Amp. _____
A Atten. 27
A Gain. _____
B Amp. _____
B Atten. 29
B Gain. _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
(Auto) A or B. _____
Cross A. or B. Del. _____
Sample Inc. 50
Recomp Del. 50
Sums 138
Word Pos. 2-3
Resumes. 0
Date APR 8 1976



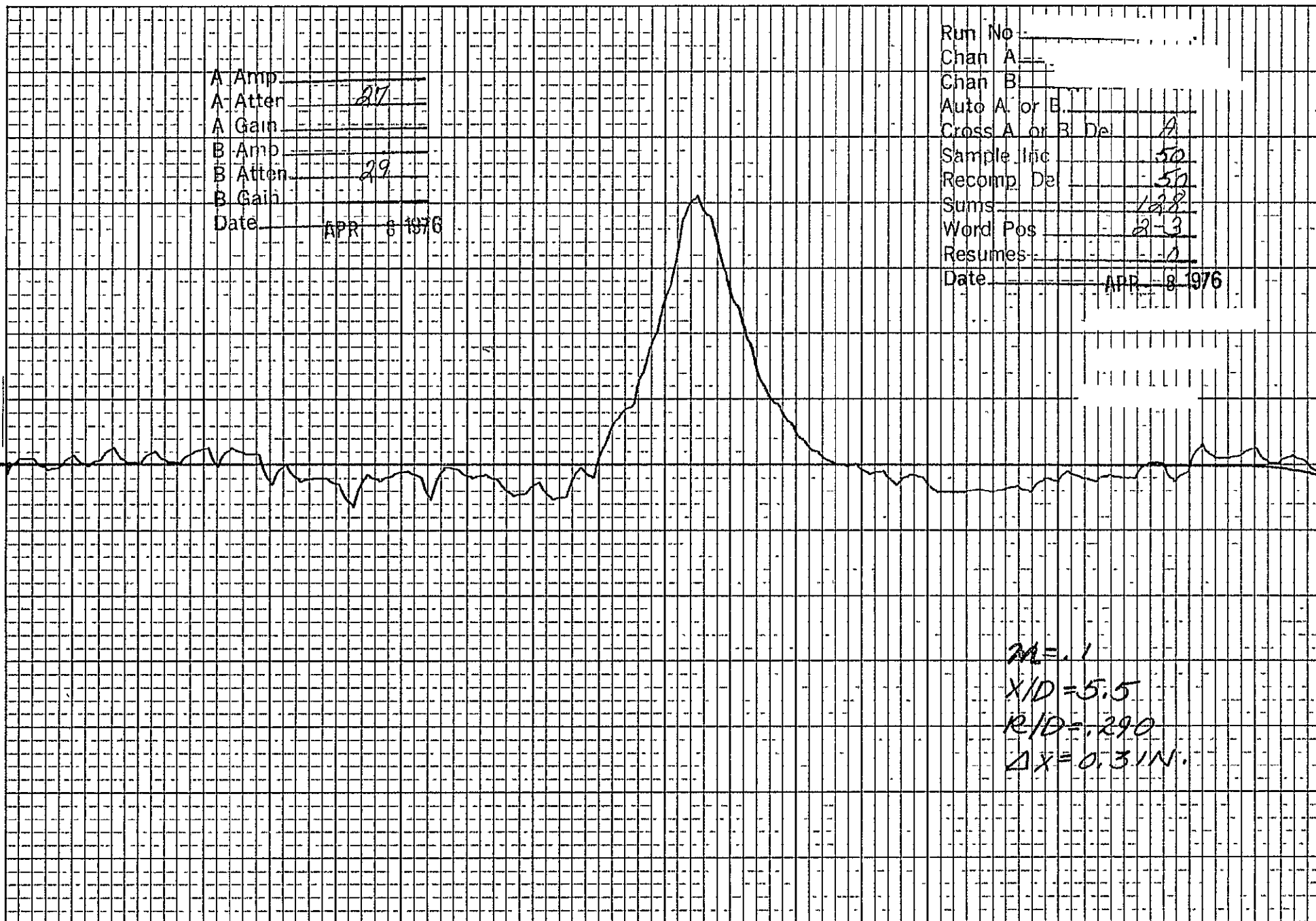
$M = .1$
 $X/D = 5.5$
 $R/D = .290$
 $\Delta X = 0.31N$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 29
B Gain _____
Date APR 8 1976

Run No _____
Chan A _____
Chan B _____
Auto A or B _____
Cross A or B De A
Sample Inc 50
Recomp De 50
Sums 128
Word Pos 213
Resumes 1
Date APR 8 1976

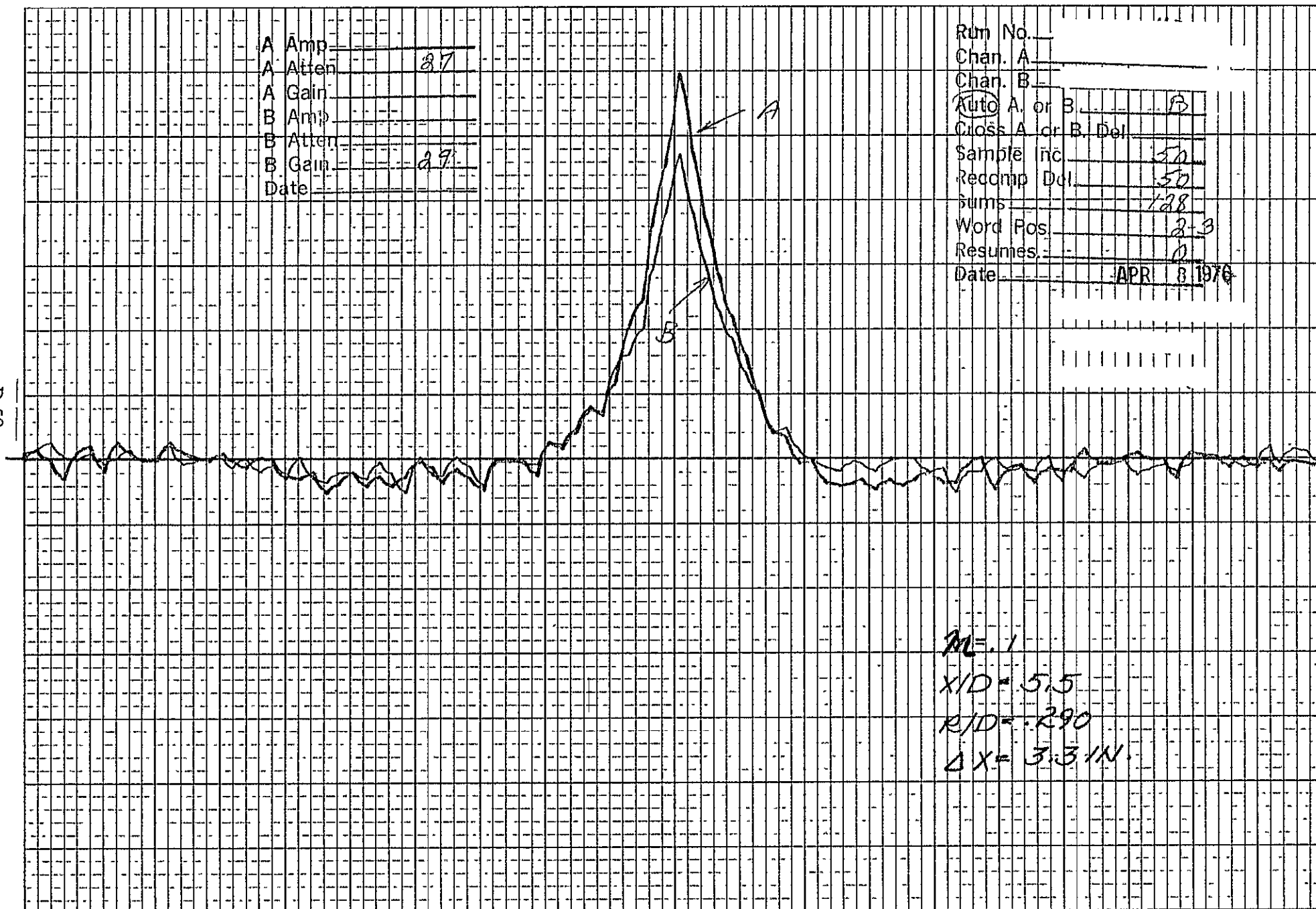
D-57



$2A = .1$
 $X/D = 5.5$
 $R/D = .290$
 $\Delta X = 0.31N.$

A Amp _____
A Atten 87
A Gain _____
B Amp _____
B Atten _____
B Gain 27
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. B
Cross A. or B. Del. _____
Sample Inc. 50
Redamp Del. 50
Burns 128
Word Pos. 2-3
Resumes. 0
Date APR 8 1970



$M = 1$
 $X/D = 5.5$
 $R/D = .290$
 $\Delta X = 3.3 \text{ IN.}$

A Amp
A Atter 27
A Gain
B Amp
B Atter 29
B Gain
Date

Run No:
Chan. A
Chan. B
Auto A or B
Cross A or B. Del A
Sample Inc. 50
Recomp Del 50
Sums 188
Word Pos 2-4
Resumes 0
Date APR 8 1976

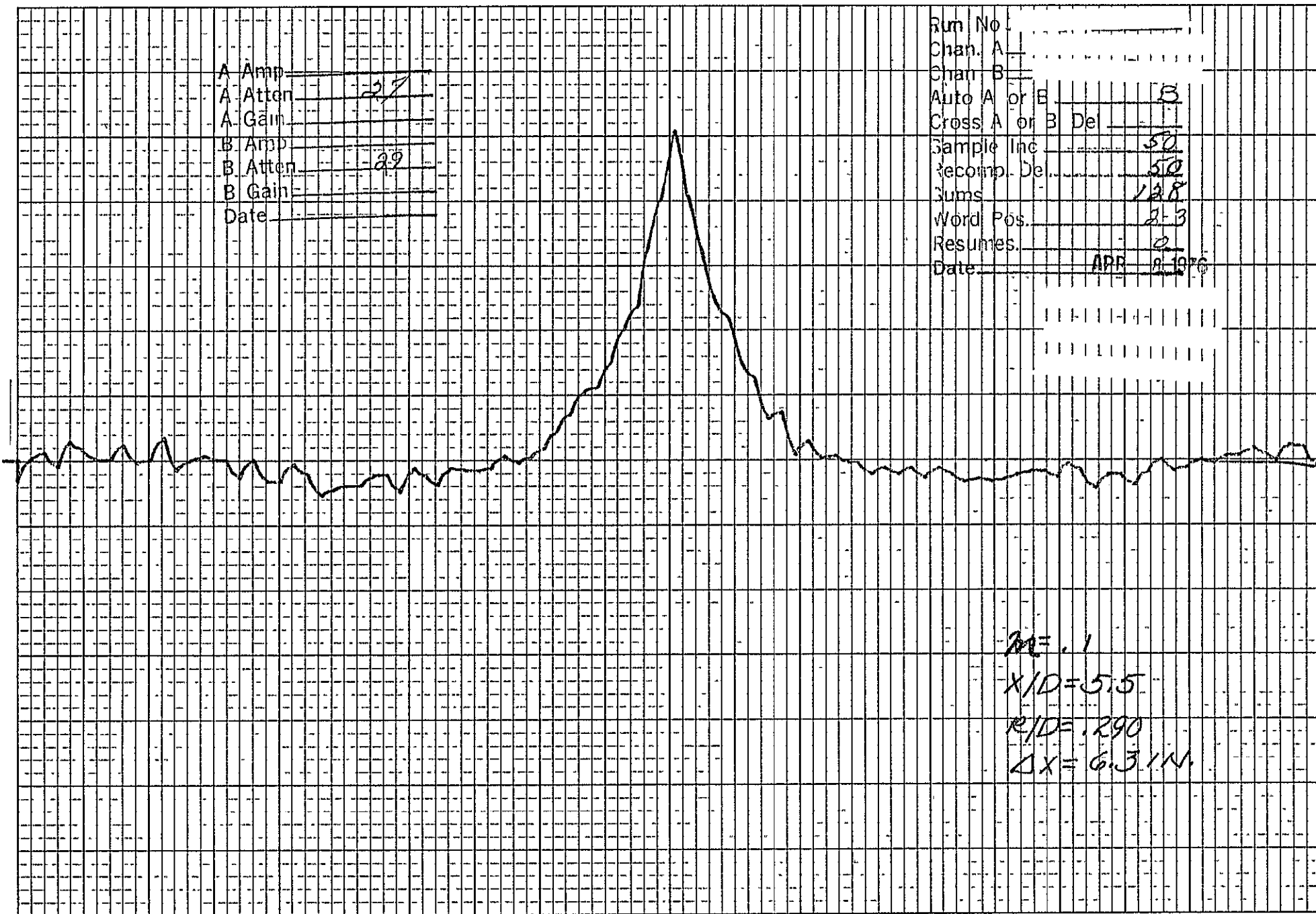
D-59

$M = .1$
 $X/D = 5.5$
 $R/D = .290$
 $\Delta X = 3.3 IN.$

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 29
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B B
Cross A or B Del _____
Sample Inc 50
Recomp. Del 50
Sums 128
Word Pos. 2.3
Resumes. 0
Date APR 8 1966

D-60

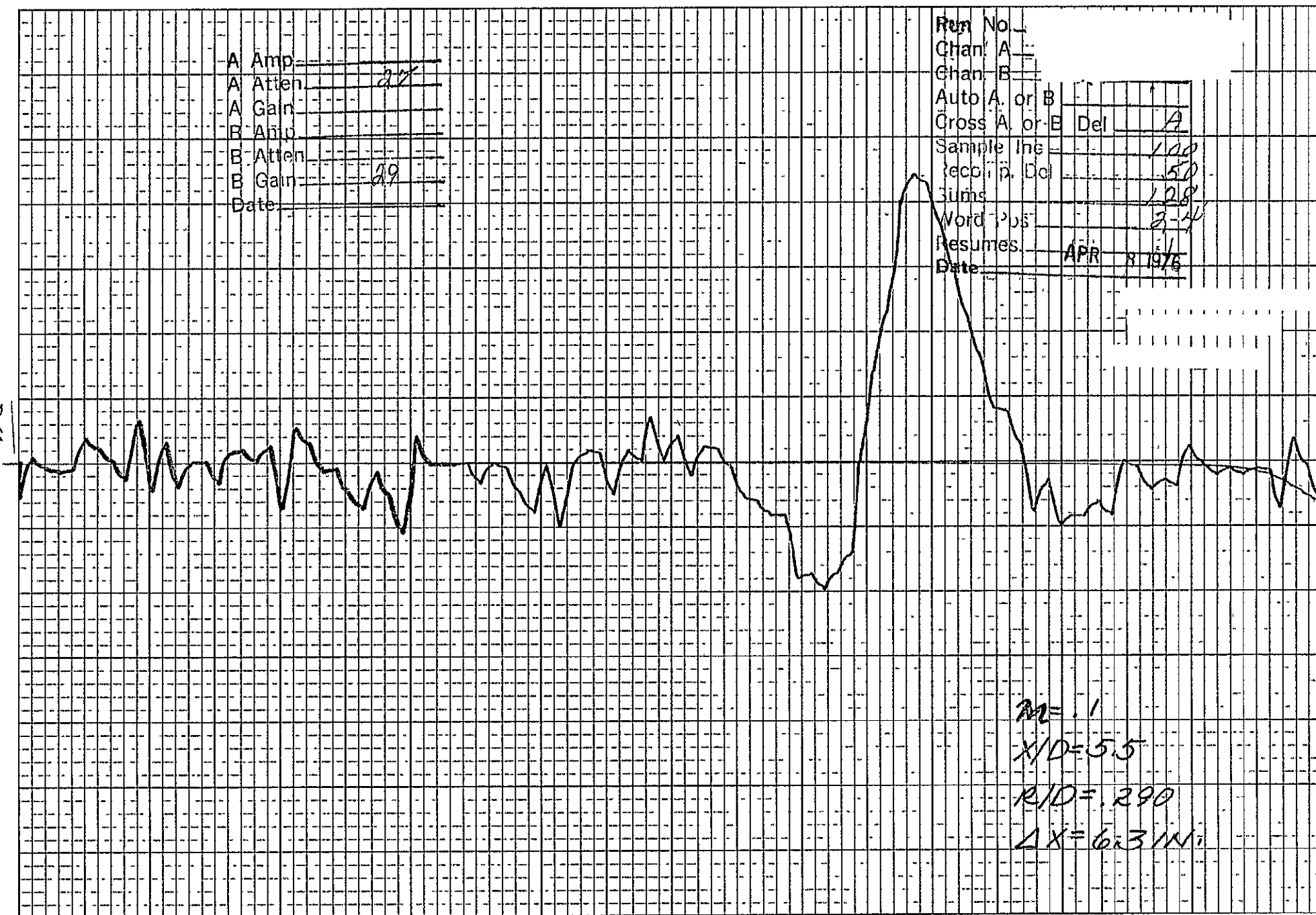


$M = .1$
 $X/D = 5.5$
 $R/D = .290$
 $\Delta X = 6.3 \text{ IN.}$

A Amp _____
A Atten. 27
A Gain _____
B Amp _____
B Atten. _____
B Gain 29
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. A
Sample Inc. 100
Recor. p. Del. 50
Sums 128
Word p. 3-4
Resumes. 1
Date APR 8 1976

D-61

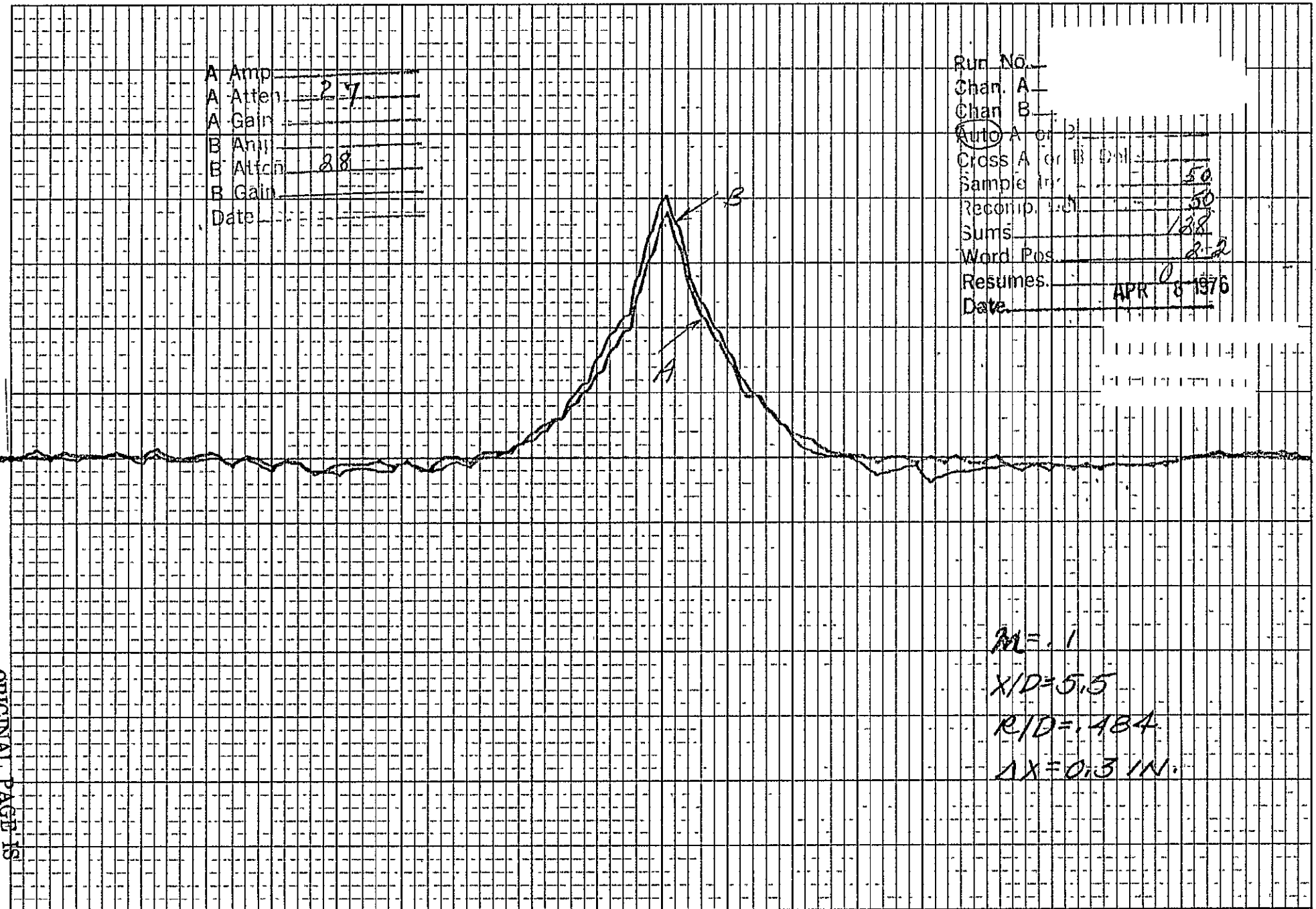


$M = .1$
 $X/D = 5.5$
 $R/D = .290$
 $\Delta X = 6.31 \text{ IN.}$

A Amp _____
A Atten. 27
A Gain _____
B Amp _____
B Atten. 28
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Dial _____
Sample Int. 50
Recomp. Int. 50
Sums 138
Word Pos. 2.2
Resumes. _____
Date APR 8 1976

D-62



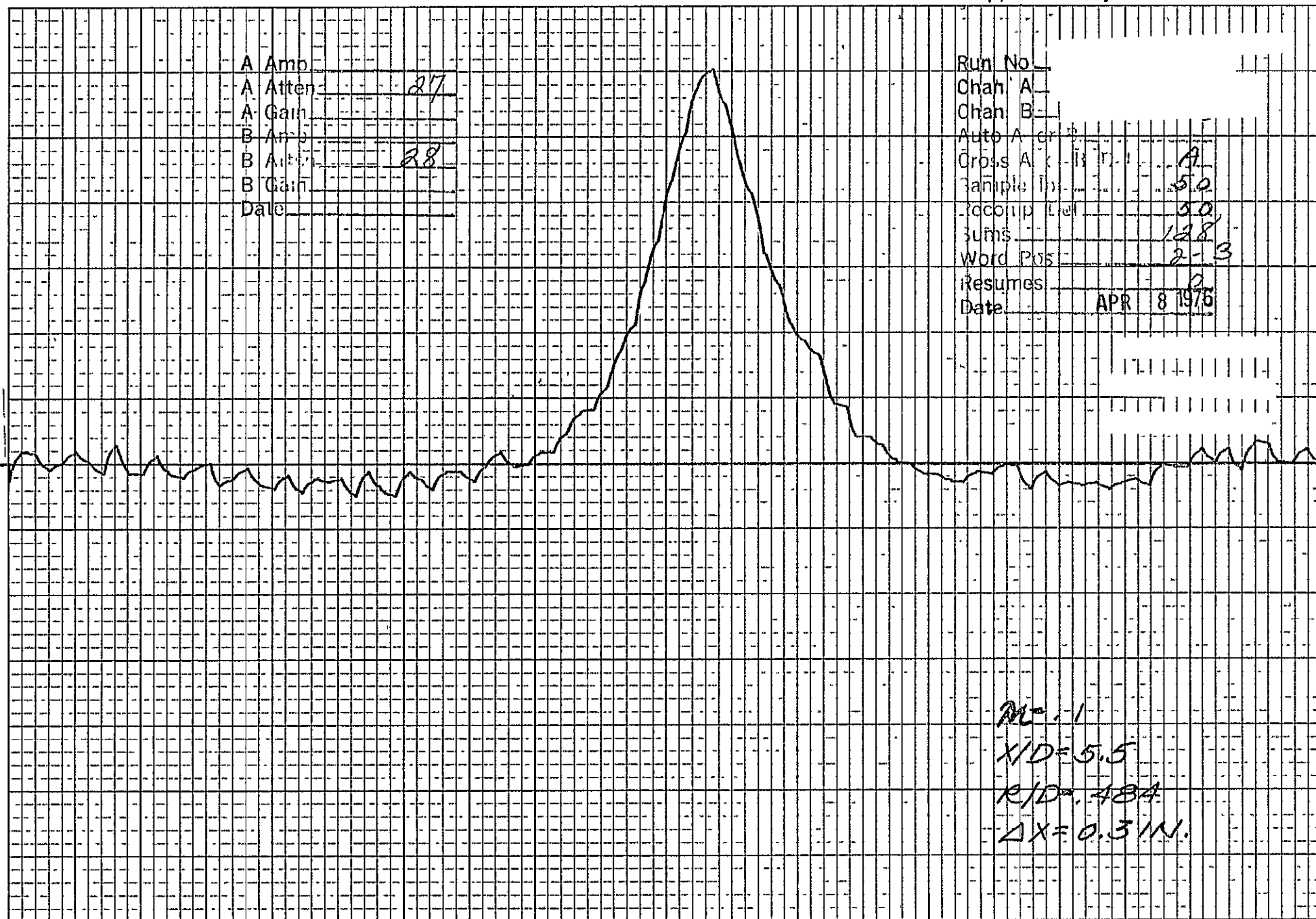
$M = .1$
 $X/D = 5.5$
 $R/D = .484$
 $\Delta X = 0.3 \text{ IN.}$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp
 A Atten 27
 A Gain
 B Amp
 B Atten 28
 B Gain
 Date

Run No. 111
 Chan A
 Chan B
 Auto A or B
 Cross A : -18 R-1 A
 Sample In 5.0
 Recomp. Del 5.0
 Sums 128
 Word Pos 2-3
 Resumes 2
 Date APR 8 1976

D-63

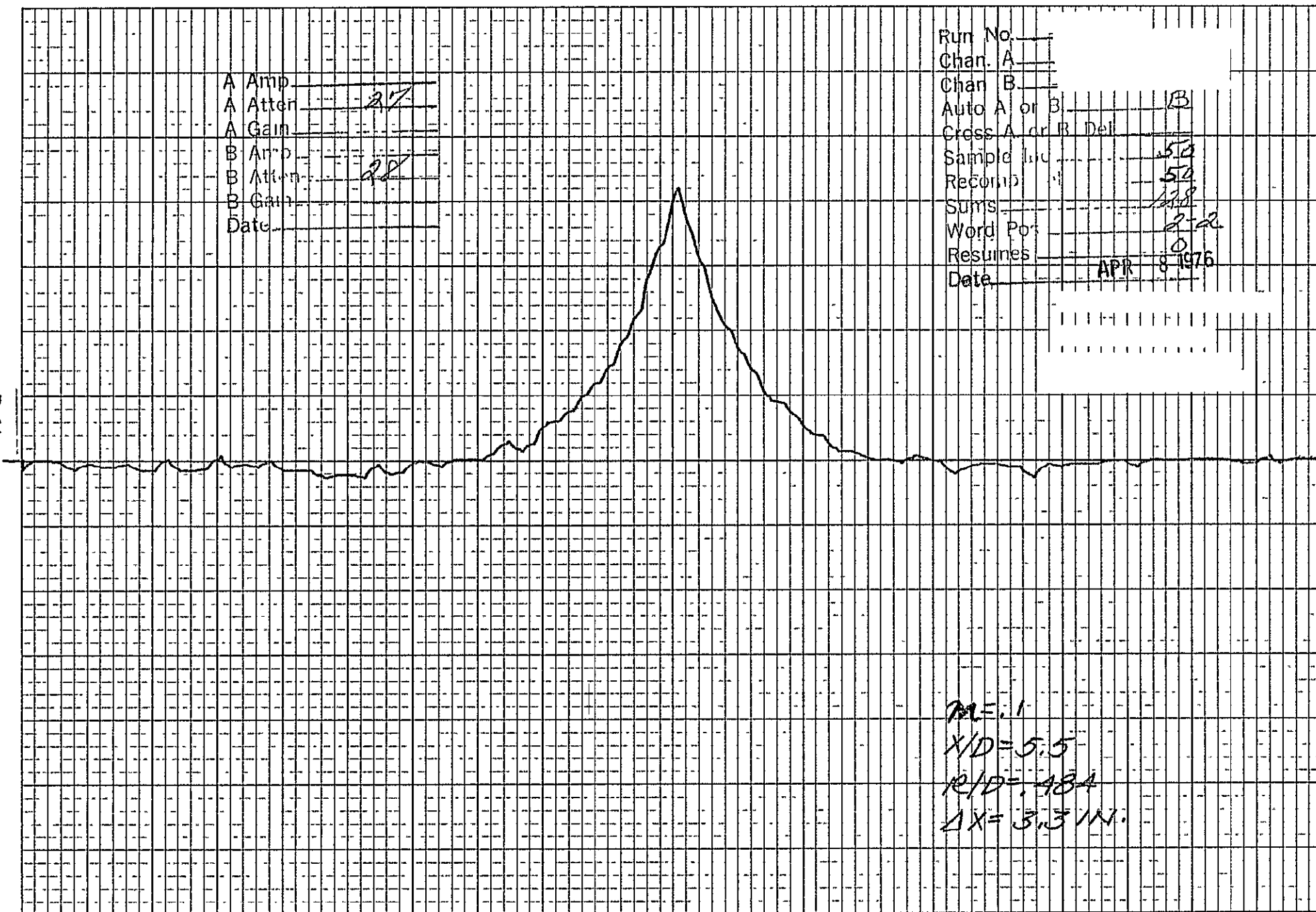


$M = .1$
 $X/D = 5.5$
 $R/D = .484$
 $\Delta X = 0.3 \text{ IN.}$

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 28
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B B
Cross A or B Del _____
Sample In 50
Record 50
Sum 138
Word Pos 2-2
Resumes 0
Date APR 8 1976

D-64



ME=1
X/D=5.5
R/D=484
ΔX=3.3 IN.

C-2

A Amp
A Atten 24
A Gain
B Atten 25
B Gain
Date

Run. No.
Chan. A
Chan. B
Auto A or B
Cross A or B. Del. A
Sample Inc 50
Recomp 0
Sum 128
Word Pcs 2-4
Resumes 0
Date APR 8 1976

D-65

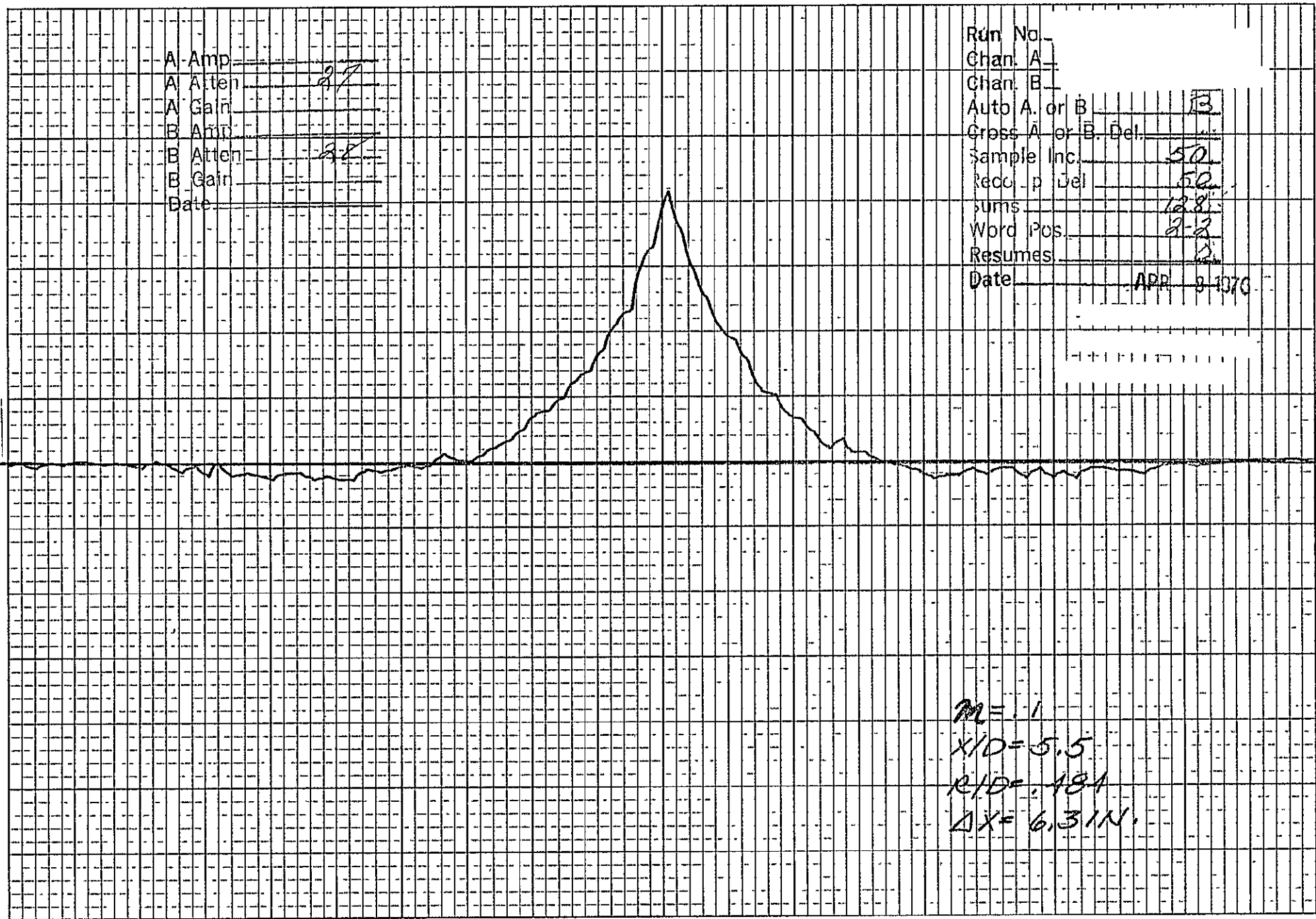
ORIGINAL PAGE IS
OF POOR QUALITY

$M = 1$
 $X/D = 5.5$
 $R/D = 484$
 $\Delta X = 3.3/W$

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 28
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. B
Cross A. or B. Del. _____
Sample Inc. 50
Recd. p. Del. 50
Sums 128
Word Pos. 2-2
Resumes 0
Date APR 8 1970

D-66



$M = 1$
 $X/D = 5.5$
 $R/D = .184$
 $\Delta X = 6.31N$

A Amp-
A Atten- 20
A Gain-
B Amp-
B Atten- 20
B Gain-
Date-

Run No-
Chan A-
Chan B-
Auto A or B-
Cross A or B Del- 4
Sample Inc- 100
Recoup Del- 0
Units- 12.8
Word Pos- 2-4
Resumes- 1
Date- APR 8 1976

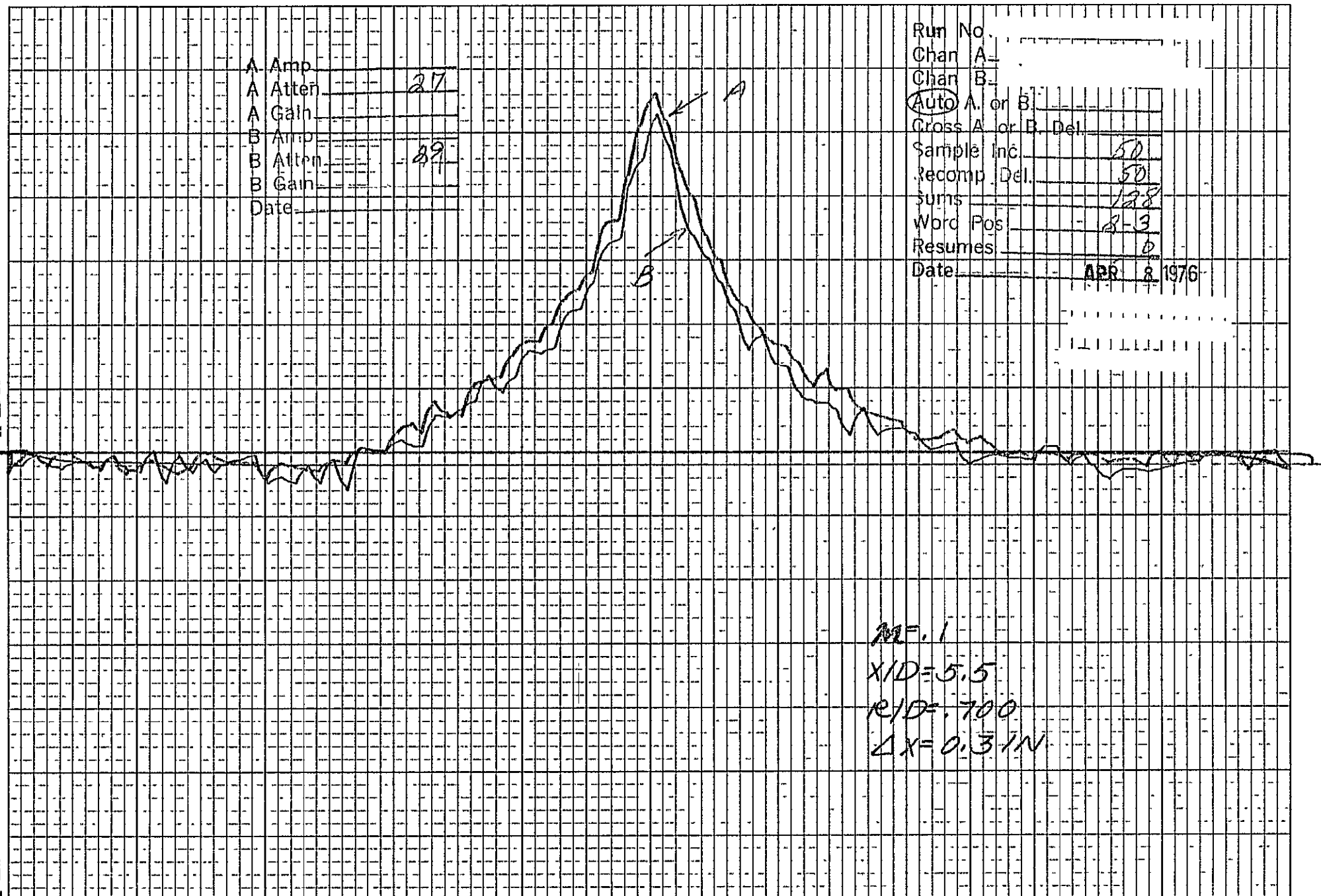
D-67

OF POOR QUALITY
SUBSTANTIAL PAGE IS

M= .1
X/D= 5.5
R/D= .484
ΔX= 6.3 IN.

A Amp
A Atten 27
A Gain
B Amp
B Atten 29
B Gain
Date

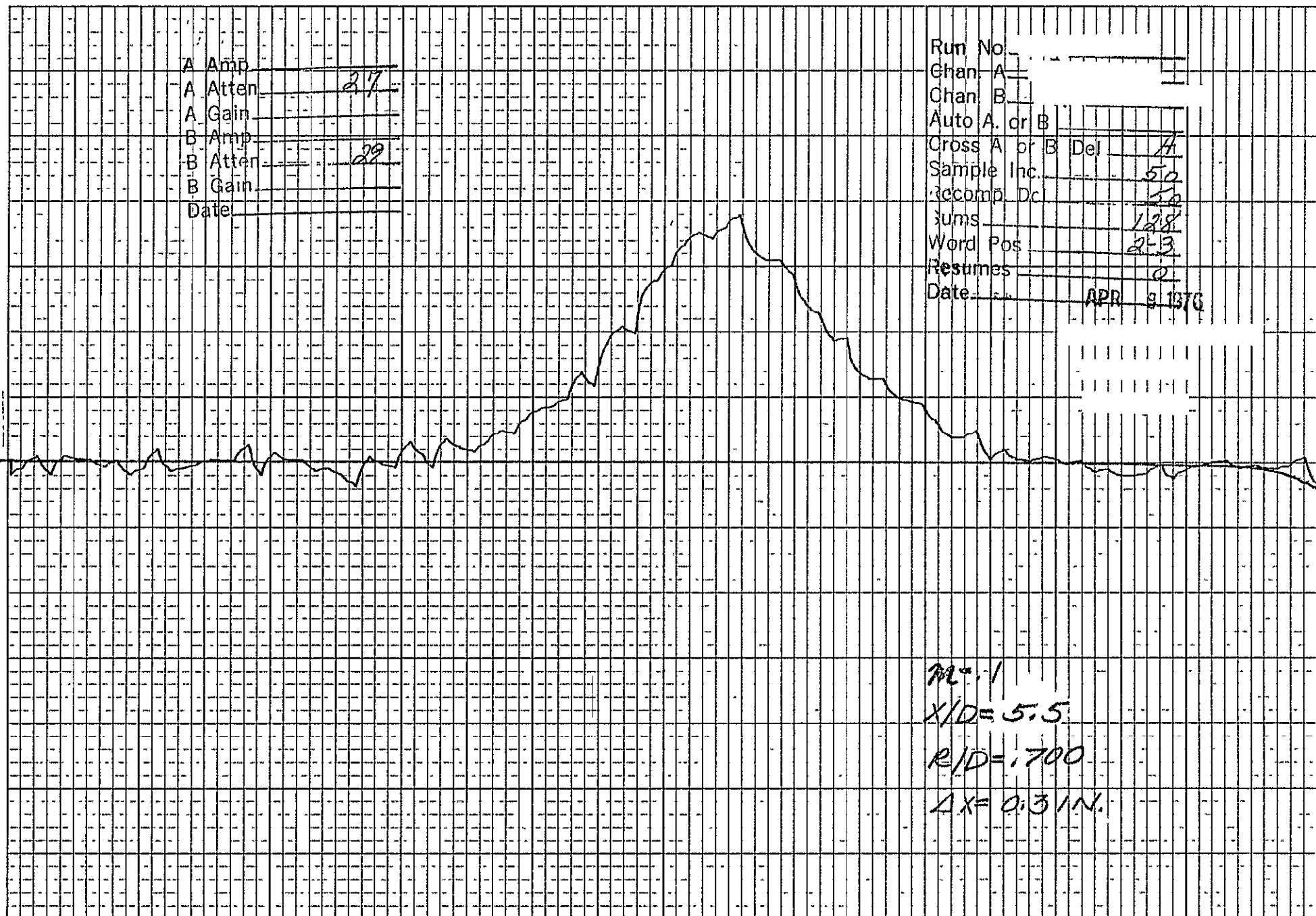
Run No.
Chan A
Chan B
Auto A. or B.
Cross A. or B. Del.
Sample Inc. 50
Recomp. Del. 50
Sums 128
Word Pos 8-3
Resumes 0
Date APR 8 1976



A Amp
A Atten 27
A Gain
B Amp
B Atten 29
B Gain
Date

Run No.
Chan A
Chan B
Auto A. or B
Cross A or B Del A
Sample Inc. 50
Recomp. Del 50
Sums 128
Word Pos 2-3
Resumes 0
Date APR 9 1976

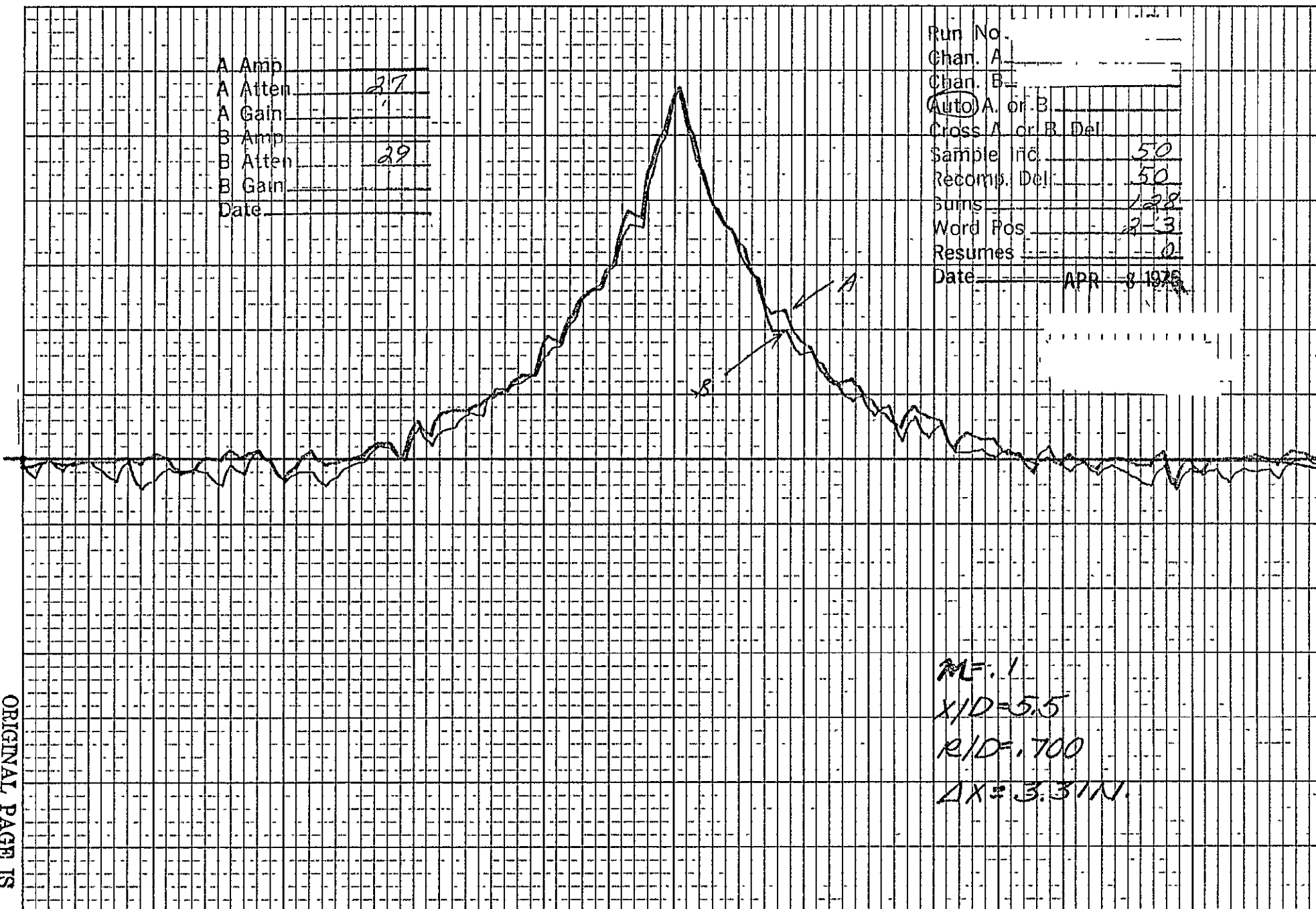
D-69



M=1
X/D=5.5
R/D=1.700
 $\Delta X = 0.31N$

A Amp _____
A Atten 27
A Gain 1
B Amp _____
B Atten 29
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
(Auto) A. or B. _____
Cross A. or B. Del _____
Sample r/c 50
Recomp. Del 50
Scans 128
Word Pos 2-3
Resumes 0
Date APR 8 1975



MF: 1
X/D = 5.5
R/D = .700
 $\Delta X = 3.31N$

D-70

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp. _____
A Atten. 27
A Gain _____
B Amp. _____
B Atten. 22
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B _____
Cross A. or B Del. A
Sample Inc. 100
Rec'd p. Del. 50
Sums 128
Word Pos. 3-4
Resumes 1
Date APR 8 1976

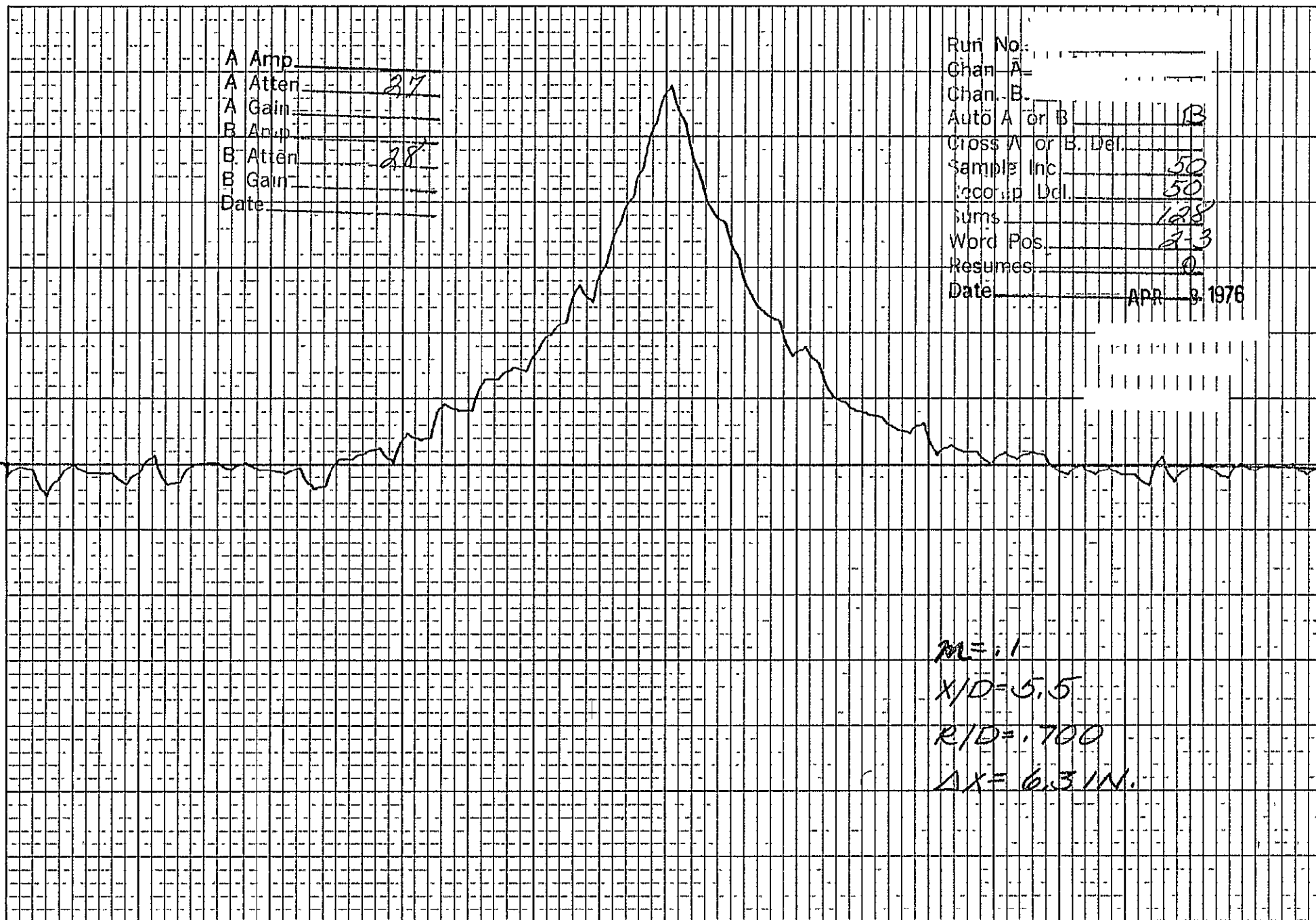
D-71

$M = 1$
 $X/D = 5.5$
 $R/D = .700$
 $\Delta X = 3.3 IN$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 28
B Gain _____
Date _____

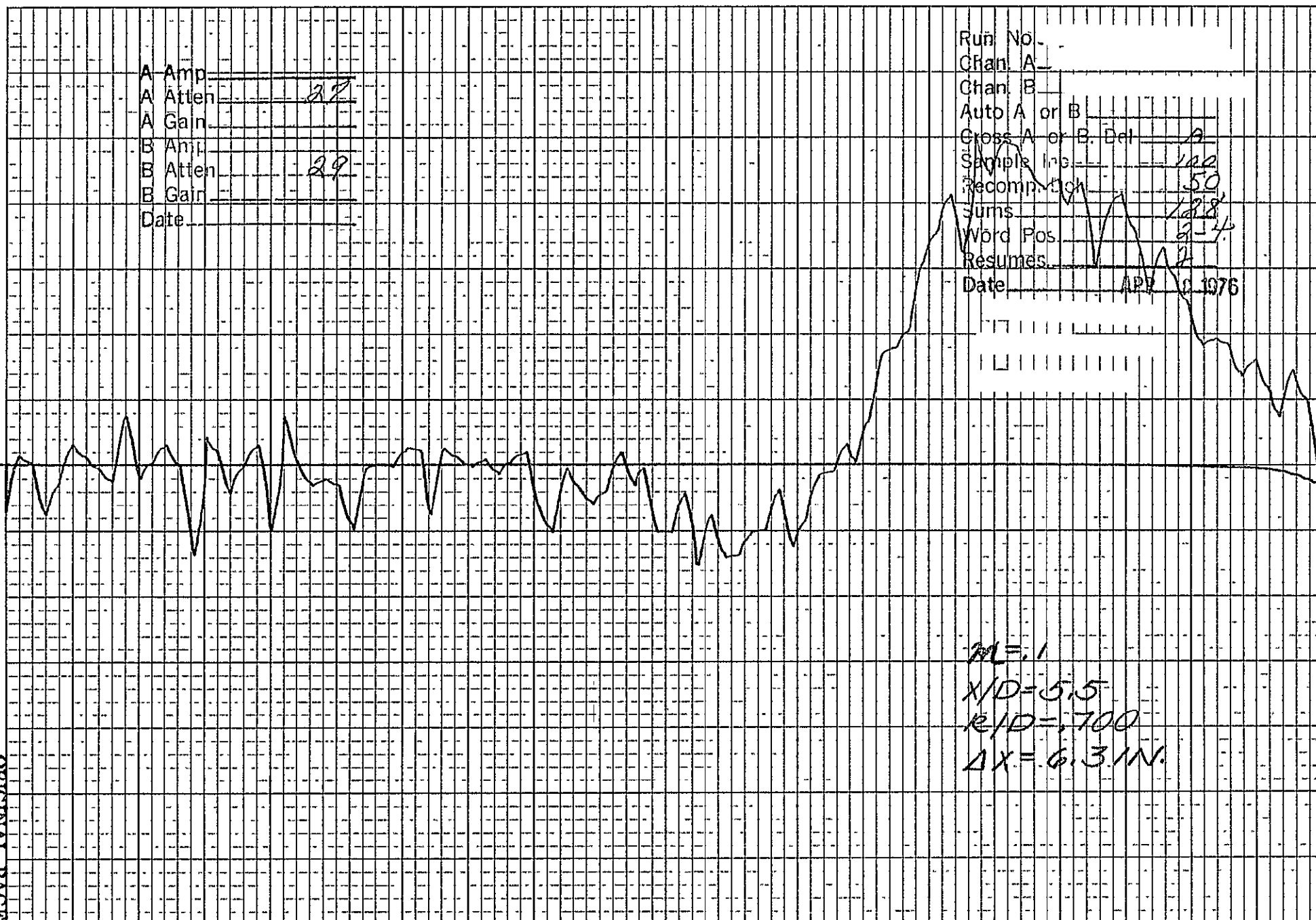
Run No. _____
Chan. A _____
Chan. B _____
Auto A or B B
Cross W or B. Del. _____
Sample Inc. 50
Record Del. 50
Sums 128
Word Pos. 23
Resumes 0
Date APR 3, 1976



$M = .1$
 $X/D = 5.5$
 $R/D = .700$
 $\Delta X = 6.3 \text{ IN.}$

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 29
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del 9
Sample Inc. 122
Recomp. Chk 50
Sums 128
Word Pos. 2-4
Resumes 2
Date APR 10 1976

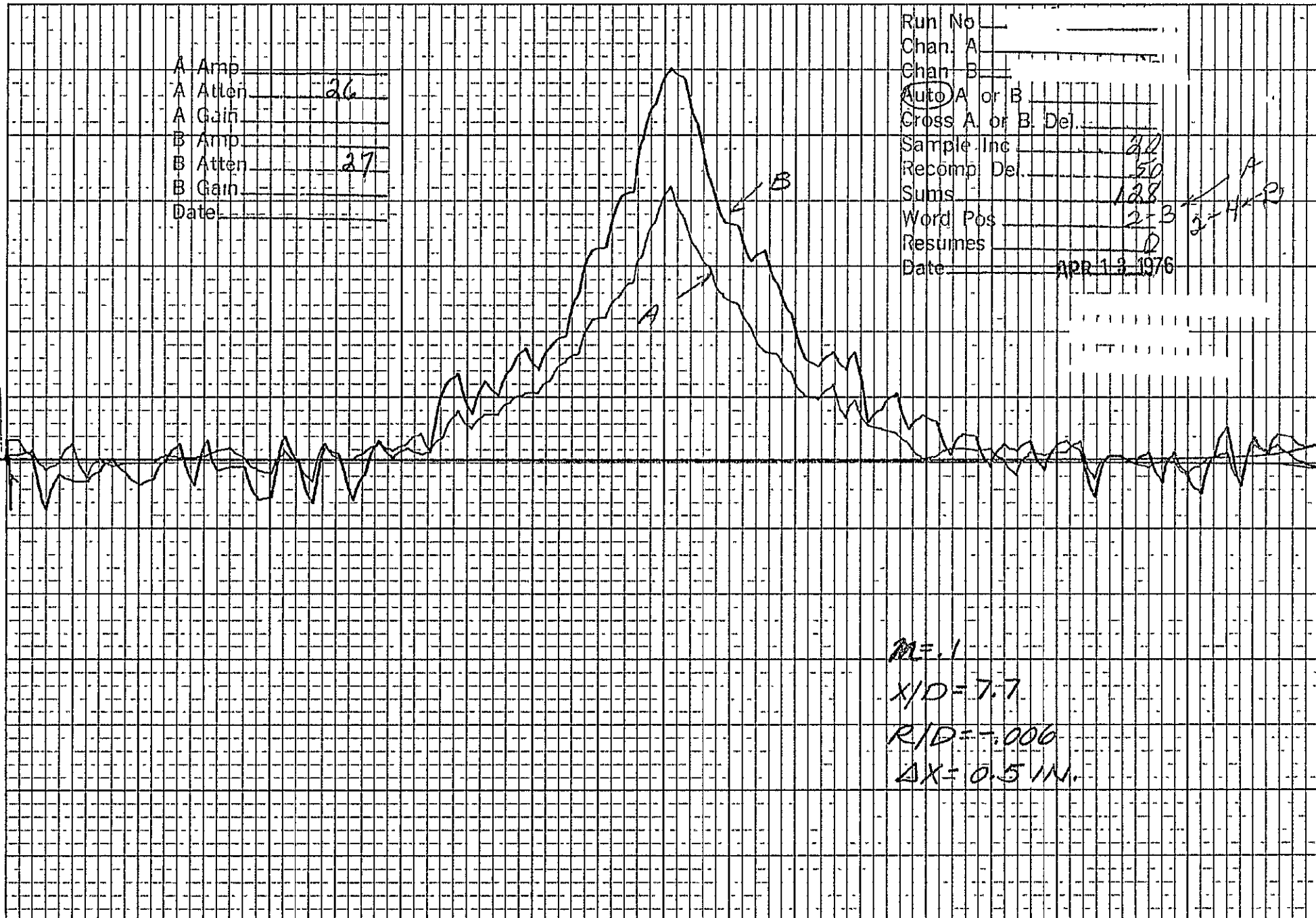


$M = .1$
 $X/D = 5.5$
 $R/D = .700$
 $\Delta X = 6.31N$

A Amp
A Atten 26
A Gain
B Amp
B Atten 27
B Gain
Date

Run No
Chan. A
Chan. B
Auto A or B
Cross A. or B. Del.
Sample Inc 30
Recomp Del 50
Sums 128
Word Pos 2-3
Resumes D
Date APR 13 1976

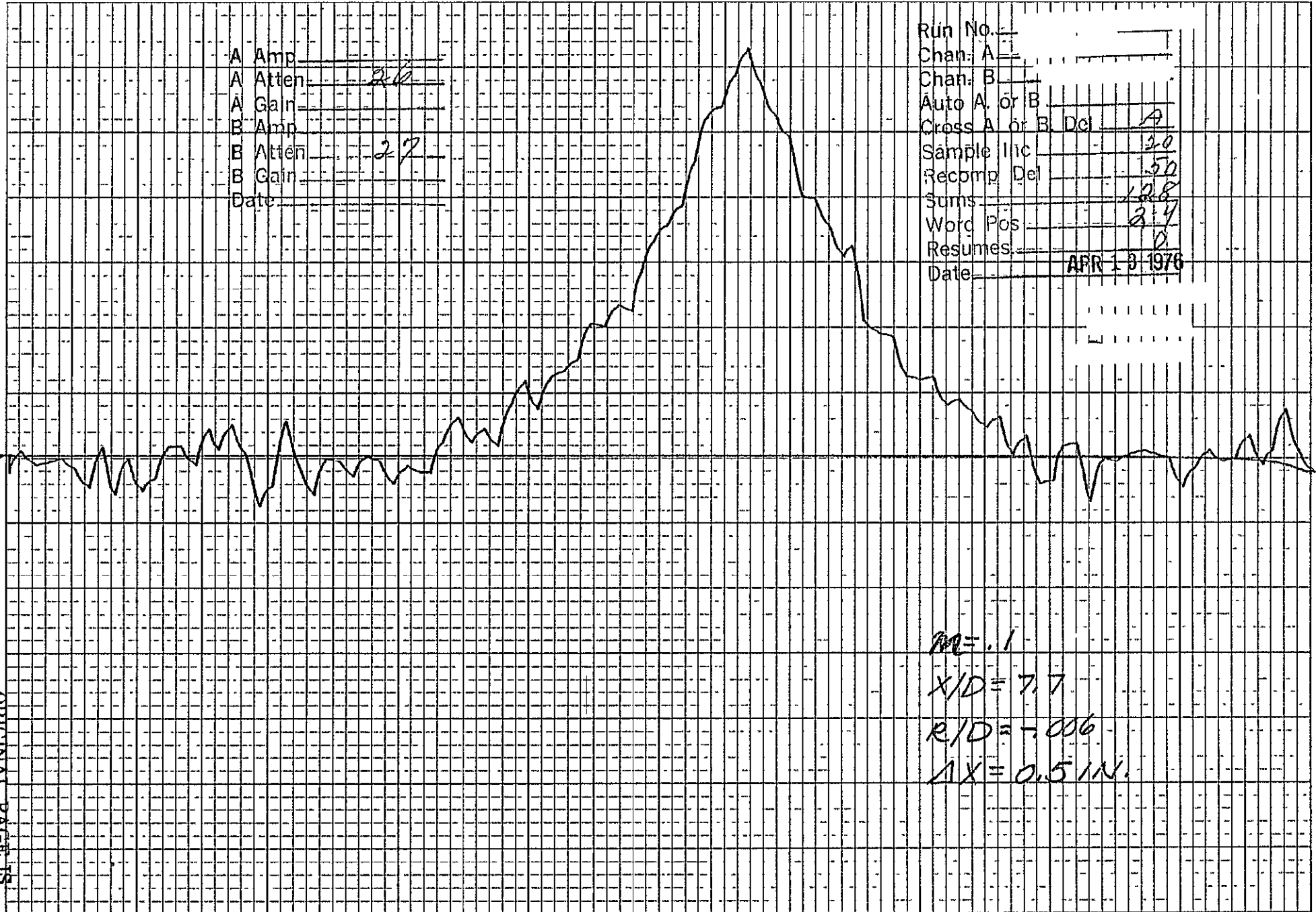
D-74



$M = .1$
 $X/D = 7.7$
 $R/D = -.006$
 $\Delta X = 0.5 \text{ in.}$

A Amp _____
A Atten _____ 26
A Gain _____
B Amp _____
B Atten _____ 27
B Gain _____
Date _____

Run No. _____
Chan: A _____
Chan: B _____
Auto A. or B. _____
Cross A. or B. Del _____ A
Sample Inc _____ 20
Recomp Del _____ 50
Sums _____ 128
Word Pos _____ 24
Resumes _____ 0
Date _____ APR 13 1976

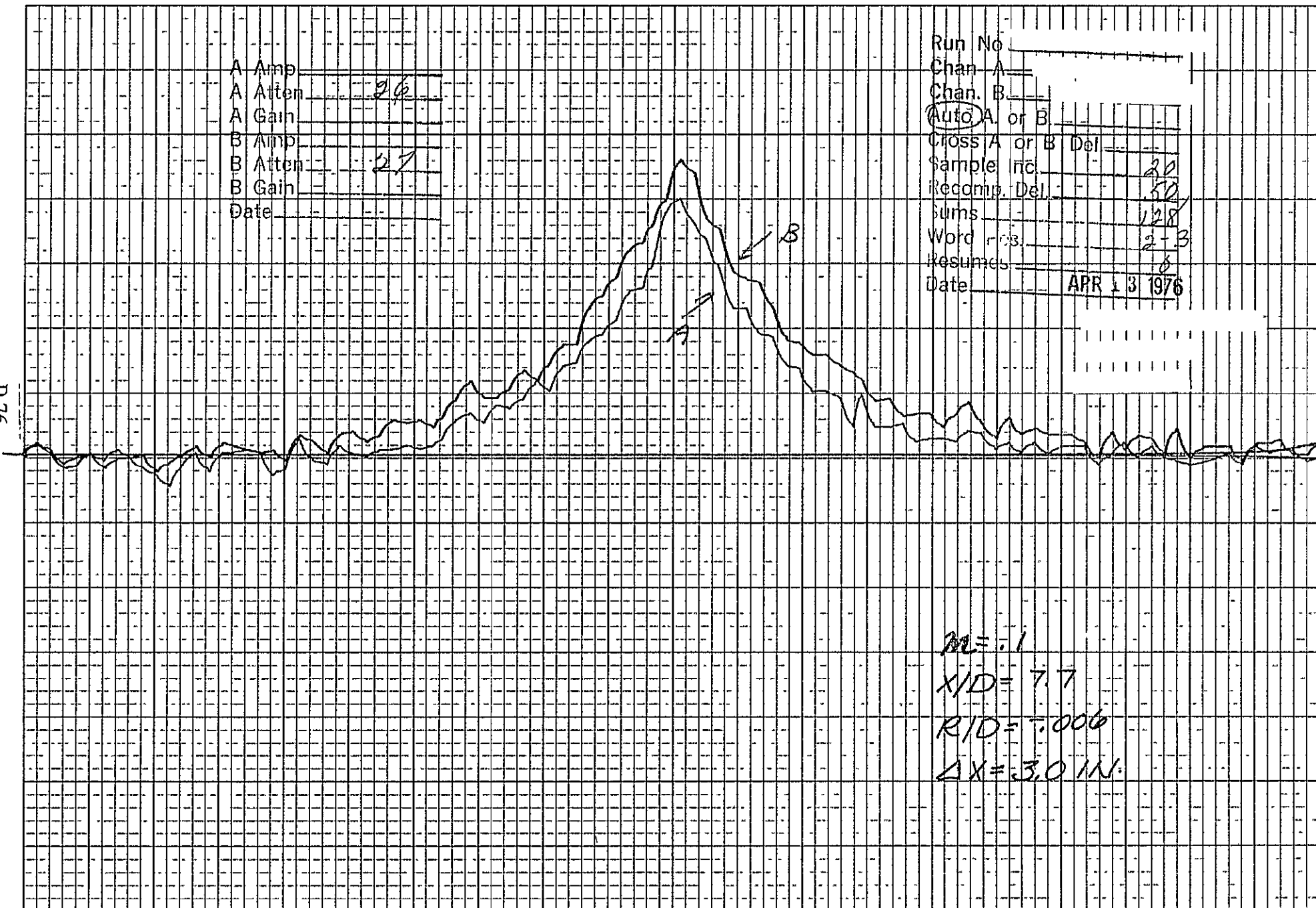


$m = .1$
 $X/D = 7.7$
 $R/D = -.006$
 $\Delta X = 0.51N.$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del _____
Sample no. 20
Recomp. Del. 50
Sums 128
Word no. 2-3
Resumes 0
Date APR 13 1976

D-76

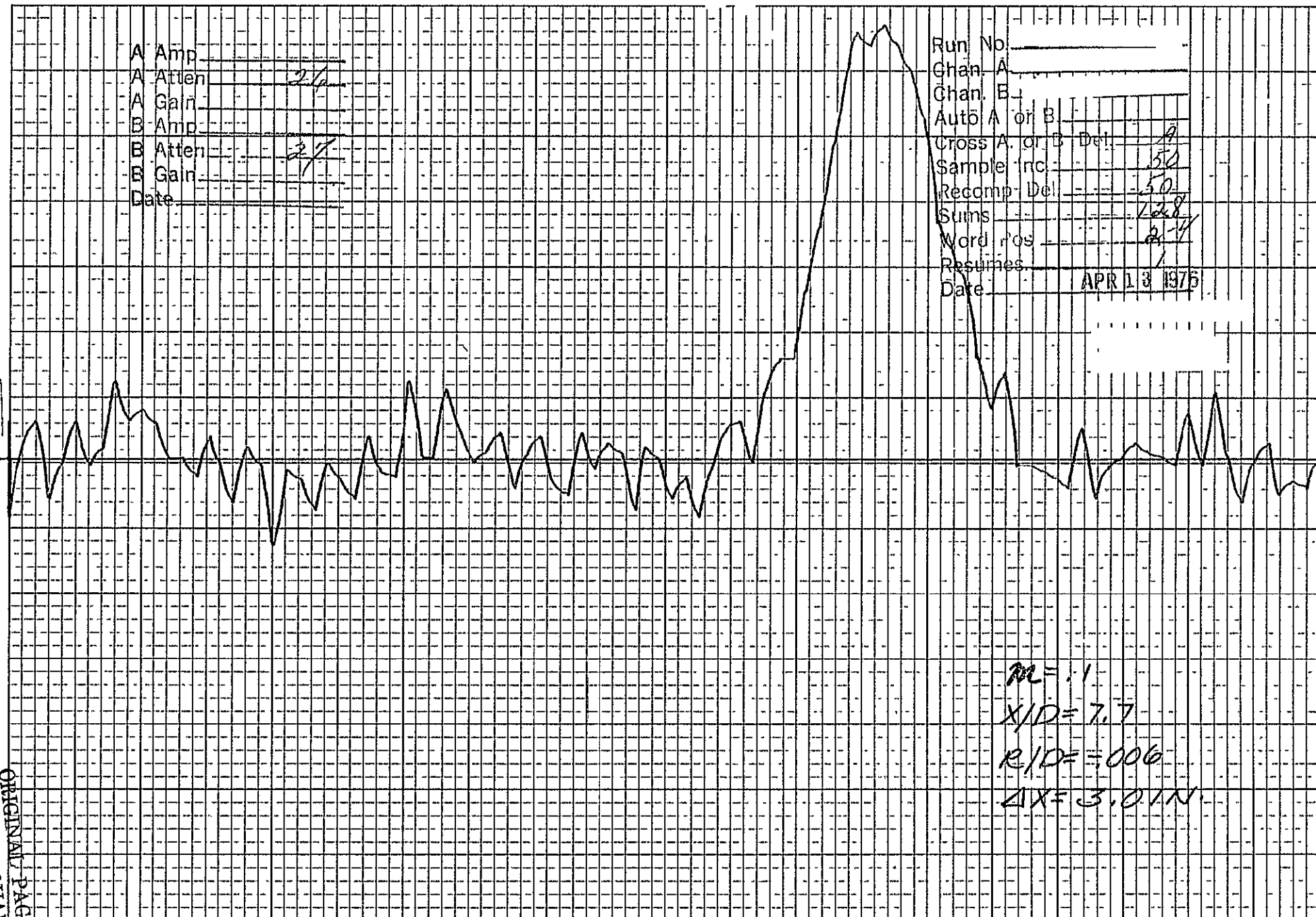


$M = .1$
 $X/D = 7.7$
 $R/D = .006$
 $\Delta X = 3.0 \text{ IN.}$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A. or B Del. 9
Sample Inc. 50
Recomp Del. 50
Sums 128
Word r'os 2-4
Resumes 1
Date APR 13 1975

D-77



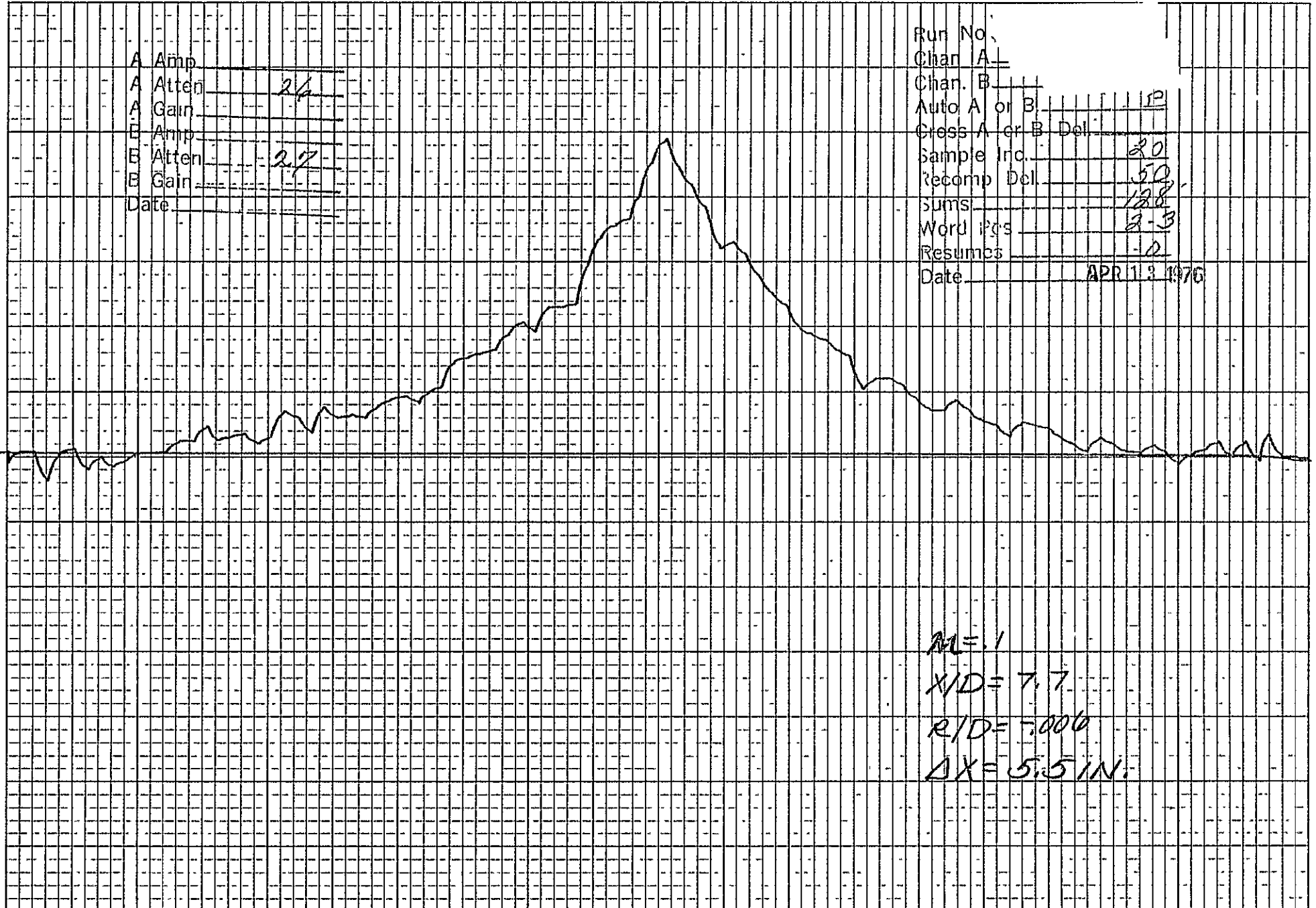
$M = .1$
 $X/D = 7.7$
 $R/D = .006$
 $\Delta X = 3.0 IN$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 24
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B 12
Cross A or B Del. _____
Sample Inc. 20
Recomp Del. 50
Sums 128
Word Pcs 2-3
Resumes 0
Date APR 13 1976

D-78



$M = .1$
 $X/D = 7.7$
 $R/D = 1.000$
 $\Delta X = 5.5 \text{ IN.}$

A Amp
A Atten 26
A Gain
B Amp
B Atten 27
B Gain
Date

Run No
Chan. A
Chan. B
Auto A. or B.
Cross A. or B. Del 4
Sample Inc. 50
Recomp Del 0
Sums 138
Word Prg 2-4
Resumes 2
Date APR 13 1976

D-79

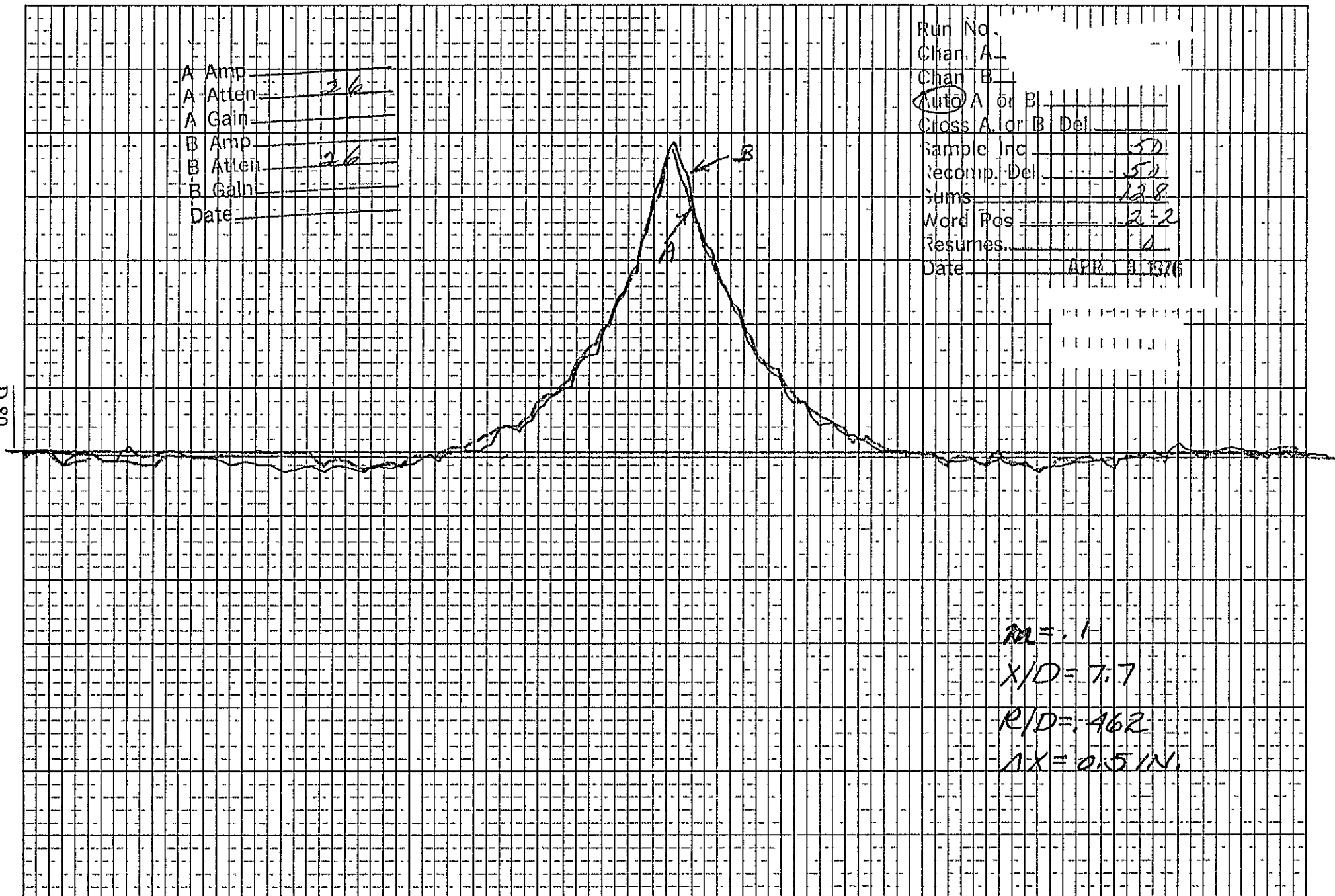
$M = .1$
 $X/D = 7.7$
 $R/D = -.006$
 $\Delta X = 5.5/M$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
 A Atten 26
 A Gain _____
 B Amp _____
 B Atten 26
 B Gain _____
 Date _____

Run No. _____
 Chan. A _____
 Chan. B _____
 Auto A or B _____
 Cross A. or B Del _____
 Sample Inc 50
 Recomp. Del 50
 Sums 128
 Word Pos 252
 Resumes 0
 Date APR 31 1976

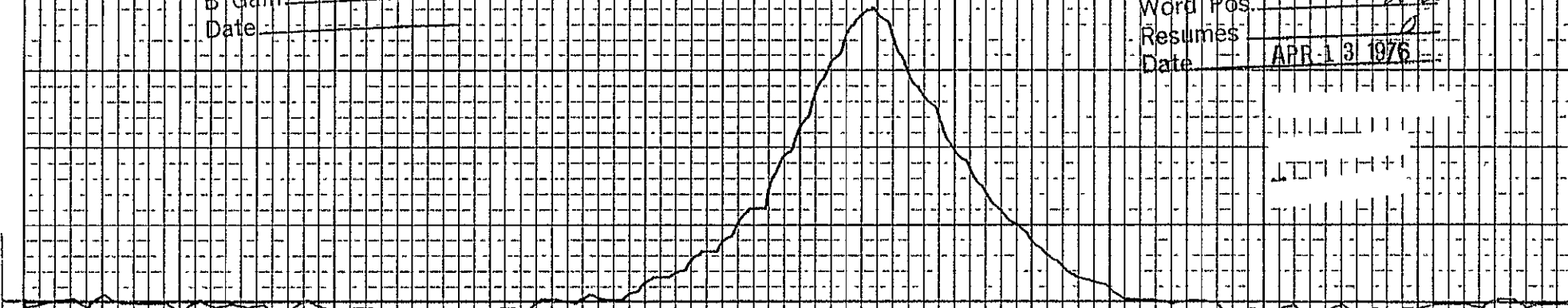
D-80



$PA = 1$
 $X/D = 7.7$
 $R/D = 462$
 $\Delta X = 0.5 \text{ IN.}$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

Run No. _____
Chan A _____
Chan B _____
Auto A. or B _____
Cross A. or B. Del 4
Sample Inc 50
Recomp. Del 50
Sums 128
Word Pos 2-2
Resumes 0
Date APR 13 1976



$R/L = .1$
 $X/D = 7.7$
 $R/D = .462$
 $\Delta X = 0.51N$

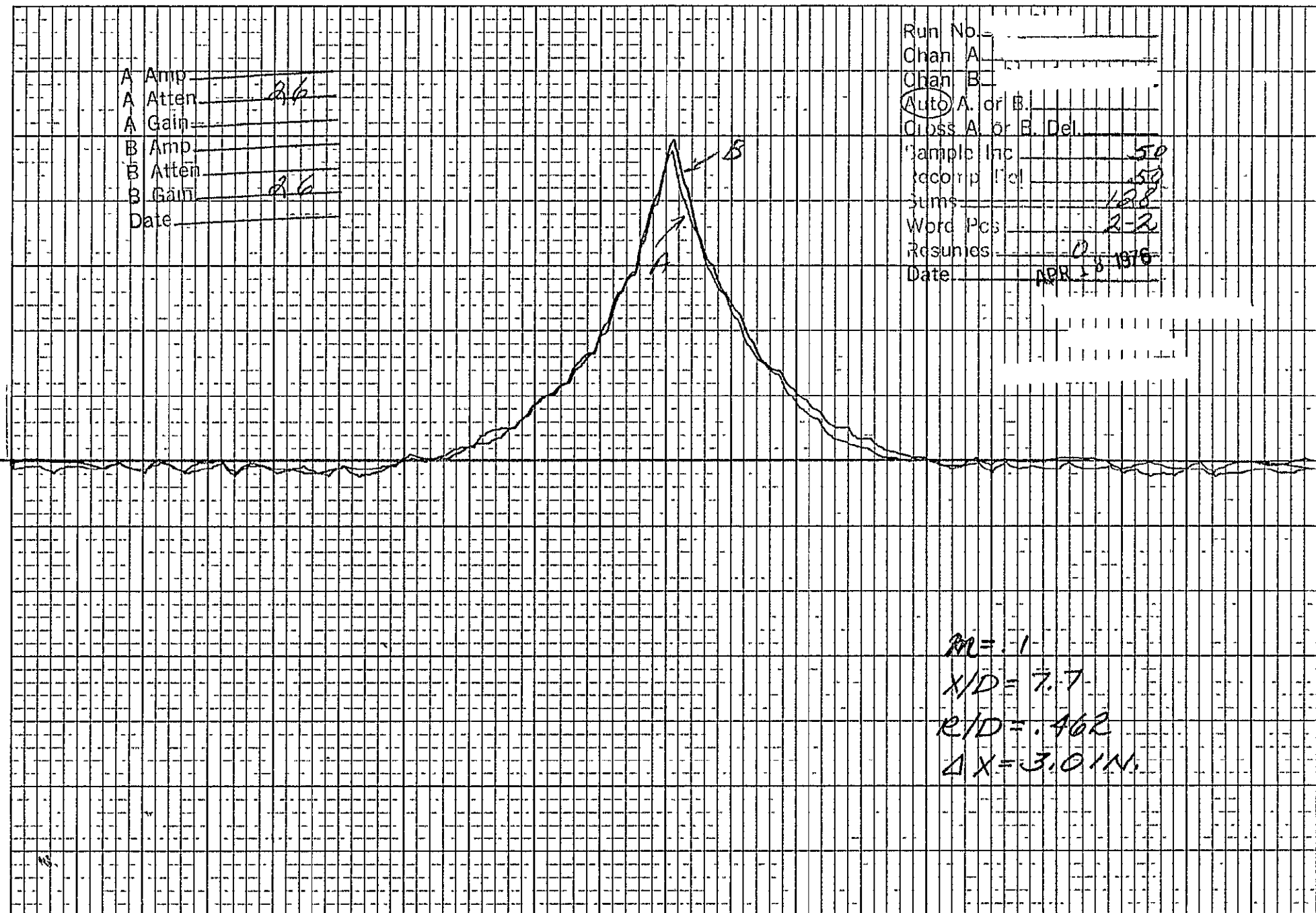
D-81

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
 A Atten 2.6
 A Gain _____
 B Amp _____
 B Atten _____
 B Gain 2.6
 Date _____

Run No. _____
 Chan A _____
 Chan B _____
 (Auto) A. or B. _____
 Cross A. or B. Del. _____
 Sample Inc 50
 Recorp Int 50
 Sums 128
 Word Pcs 2-2
 Resumes 0
 Date APR 28 1976

D-82



$R = .1$
 $X/D = 7.7$
 $R/D = .462$
 $\Delta X = 3.0 \text{ IN.}$

A Amp 26
A Atten 26
A Gain 26
B Amp 26
B Atten 26
B Gain 26
Date 26

Run No
Chan A
Chan B
Auto A or B
Cross A or B Del 2
Sample Inc 10
Recomp. Del. 50
Sum 128
Word Pos 2-3
Resumes 0
Date APR 3 1976

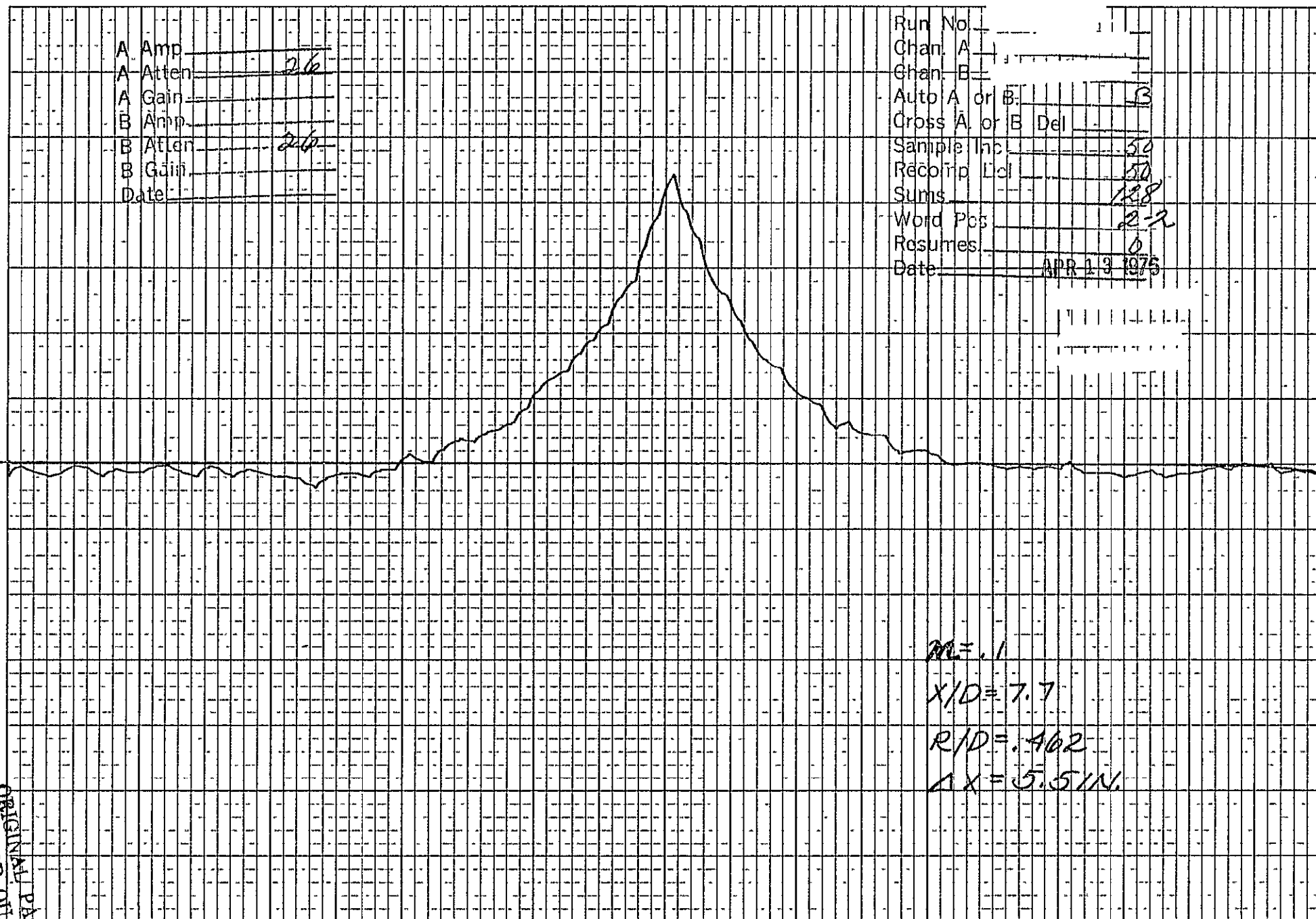
D-83

ORIGINAL PAGE IS
OF POOR QUALITY

$M = .1$
 $X/D = 7.7$
 $R/D = .462$
 $\Delta X = 3.0 \text{ IN.}$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B: B
Cross A or B Del _____
Sample Inc _____
Recorip Lcl _____
Sums 128
Word Pos 2-2
Resumes 0
Date APR 13 1975



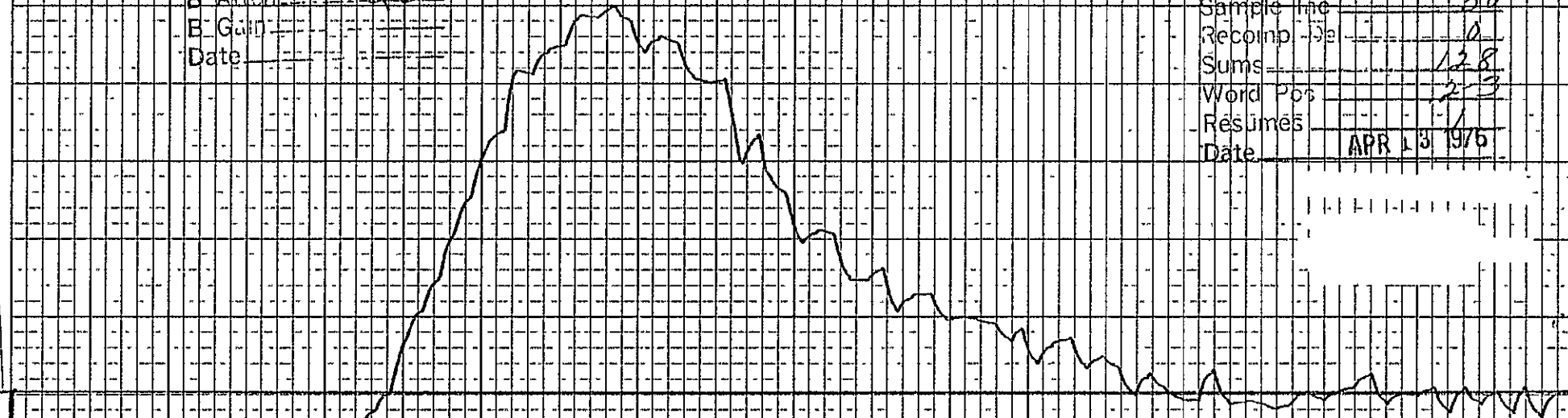
$M = .1$
 $X/D = 7.7$
 $R/D = .462$
 $\Delta X = 5.51N$

D-84

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

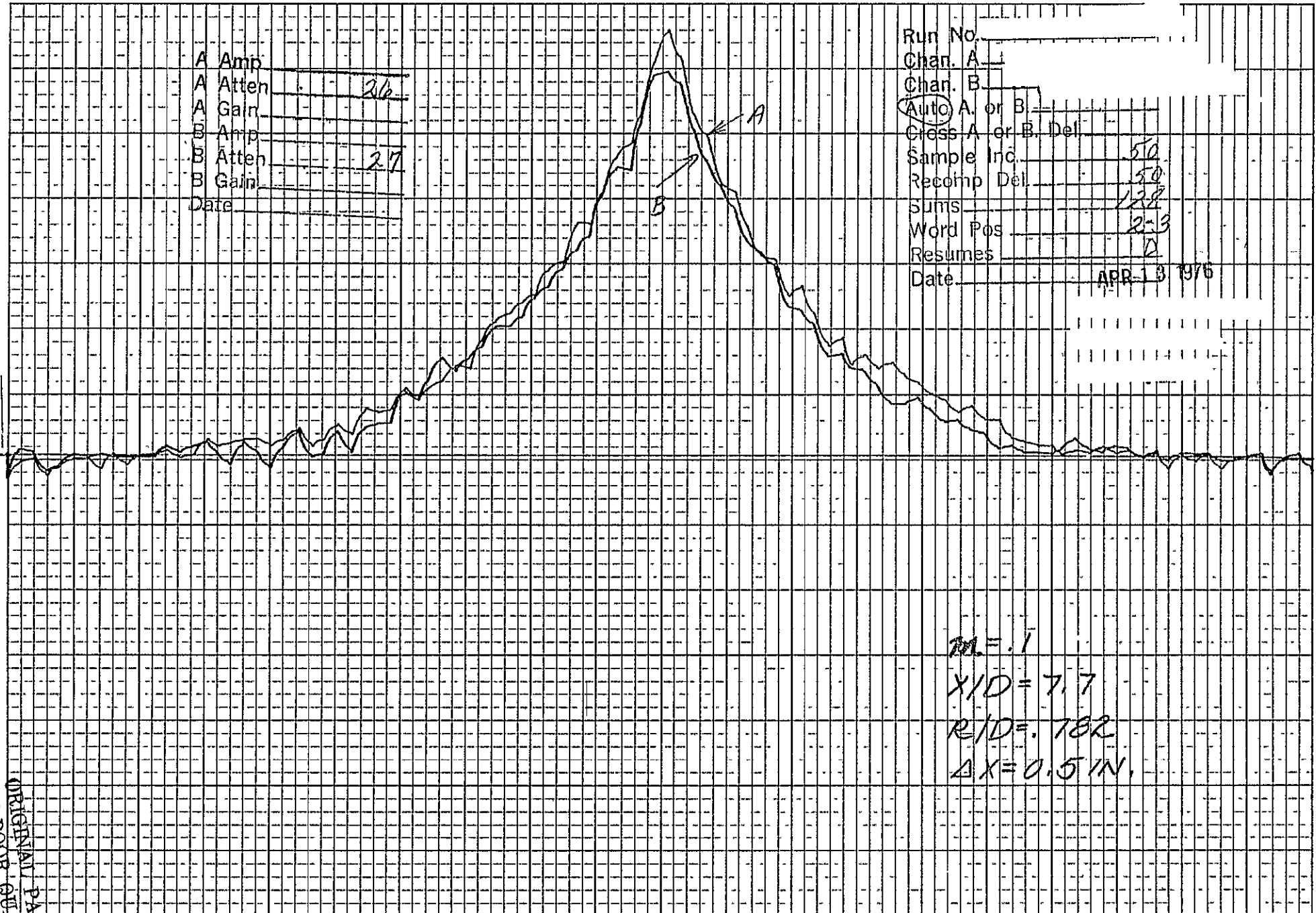
Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. 2
Sample Inc. 50
Recomp. Del. 0
Sums 128
Word Pos. 23
Resumes 1
Date APR 13 1976



$M = 1.1$
 $X/D = 7.7$
 $R/D = .462$
 $\Delta X = 5.5 \text{ IN.}$

A Amp
A Atten 26
A Gain
B Amp
B Atten 27
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A. or B.
Cross A. or B. Del.
Sample Inc. 50
Recomp Del. 50
Sums 128
Word Pos 2-3
Resumes 2
Date APR 13 1976



$M = .1$
 $X/D = 7.7$
 $R/D = .782$
 $\Delta X = 0.5 \text{ IN.}$

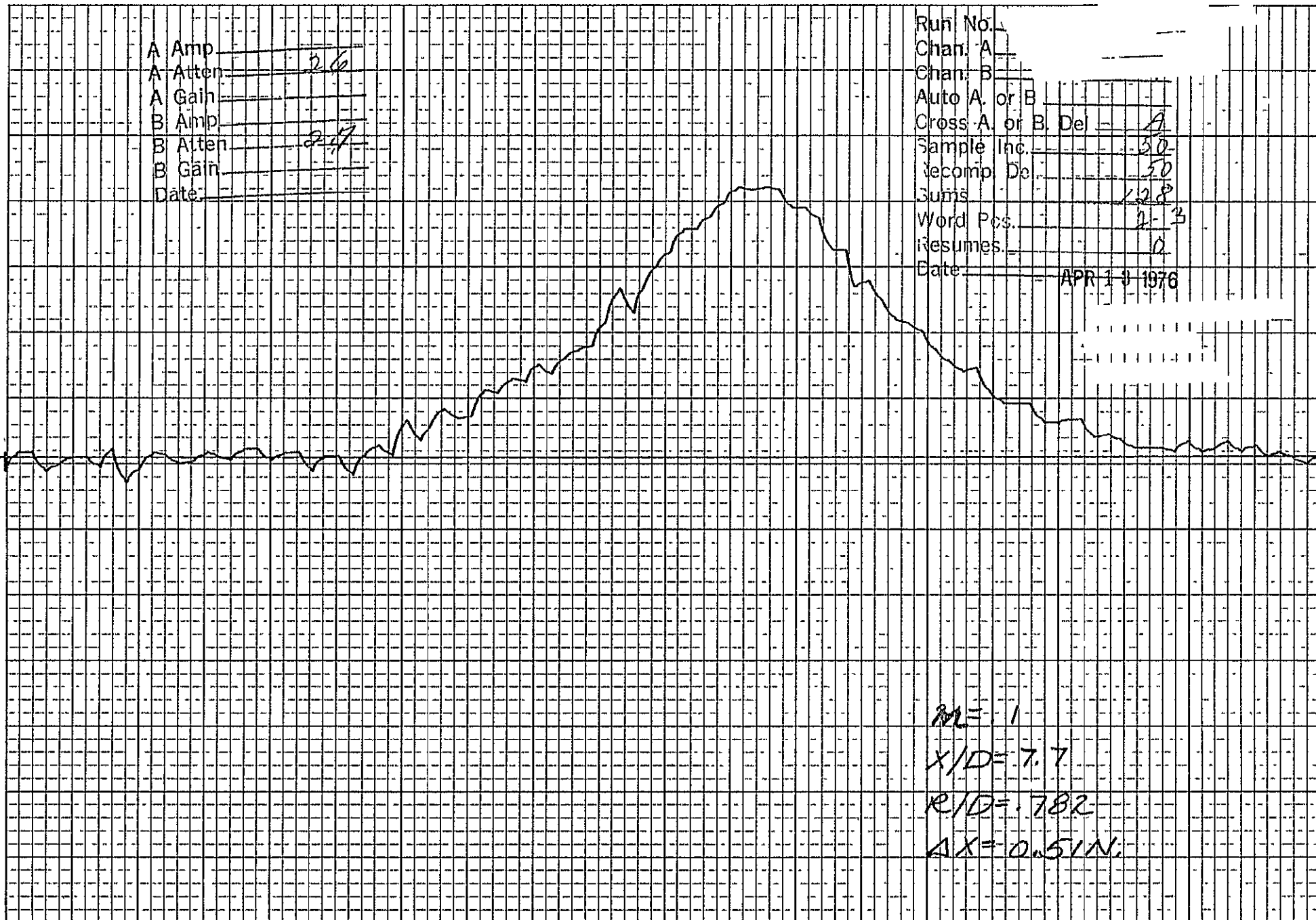
D-86

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten. 26
A Gain _____
B Amp _____
B Atten. 27
B Gain _____
Date: _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. A
Sample Inc. 50
Decomp. Del. 50
Sum. 128
Word Pcs. 2-3
Resumes. 0
Date: APR 10 1976

D-87

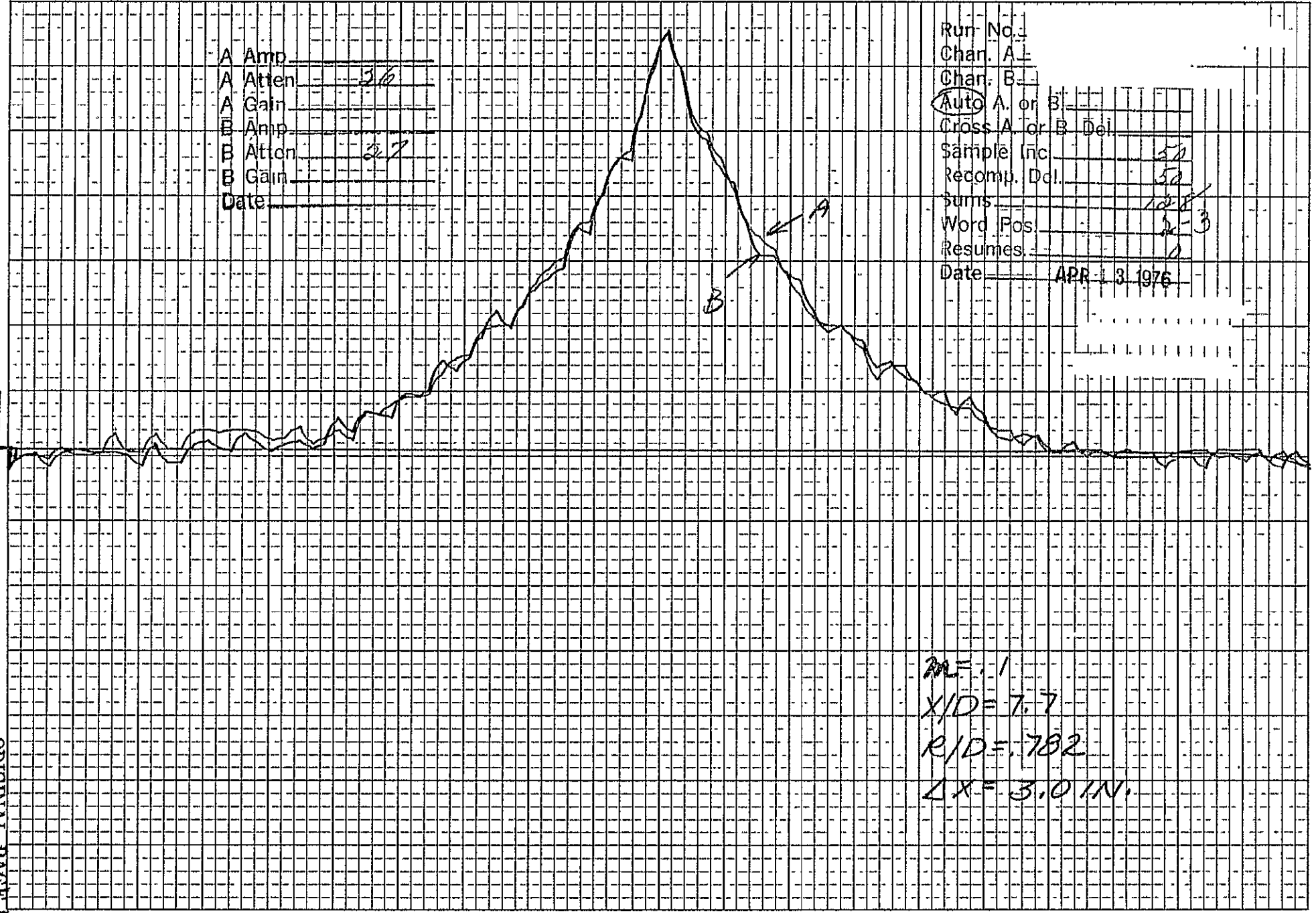


$M = 1$
 $X/D = 7.7$
 $R/D = .782$
 $AX = 0.51N$

A Amp _____
A Atten. 26
A Gain _____
B Amp _____
B Atten. 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. _____
Sample Inc. 50
Recomp. Del. 50
Burns 128
Word Pos. 2-3
Resumes 0
Date APR 13 1976

D-88



ME-1
X/D = 7.7
R/D = 782
 $\Delta X = 3.0 \text{ IN.}$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del 2
Sample Inc 100
Recomp. Del 50
Sums 128
Word Pos 2-3
Resumes 1
Date APR 19 1976

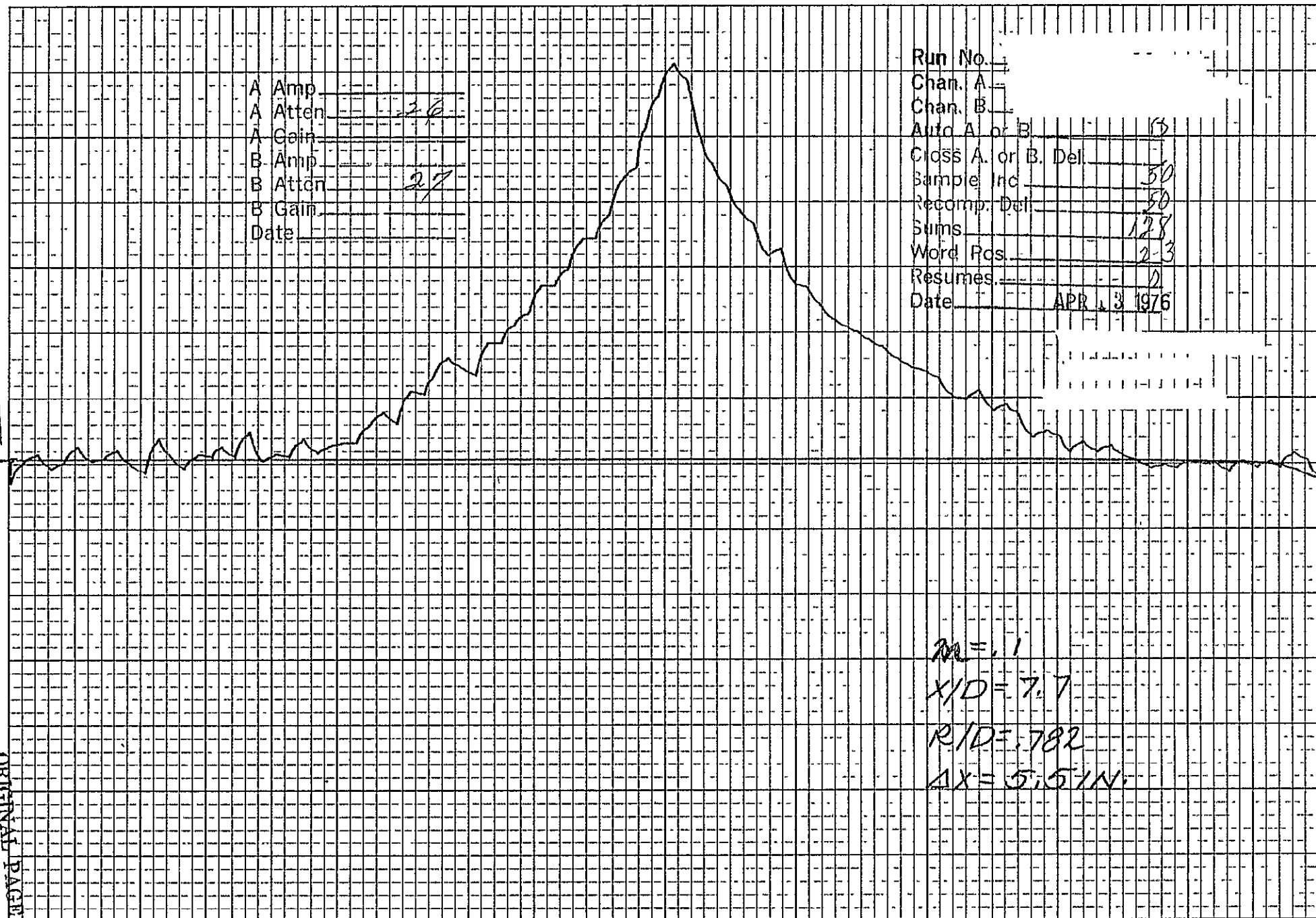
D-89

$ME = 1$
 $X/D = 7.7$
 $R/D = .782$
 $\Delta X = 3.0 \text{ IN.}$

A Amp _____
A Atten. 26
A Gain _____
B Amp _____
B Atten. 27
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B. 16
Cross A. or B. Del. _____
Sample Inc. 50
Recomp. Del. 50
Sums 128
Word Pcs. 2-3
Resumes. 0
Date APR 13 1976

D-90

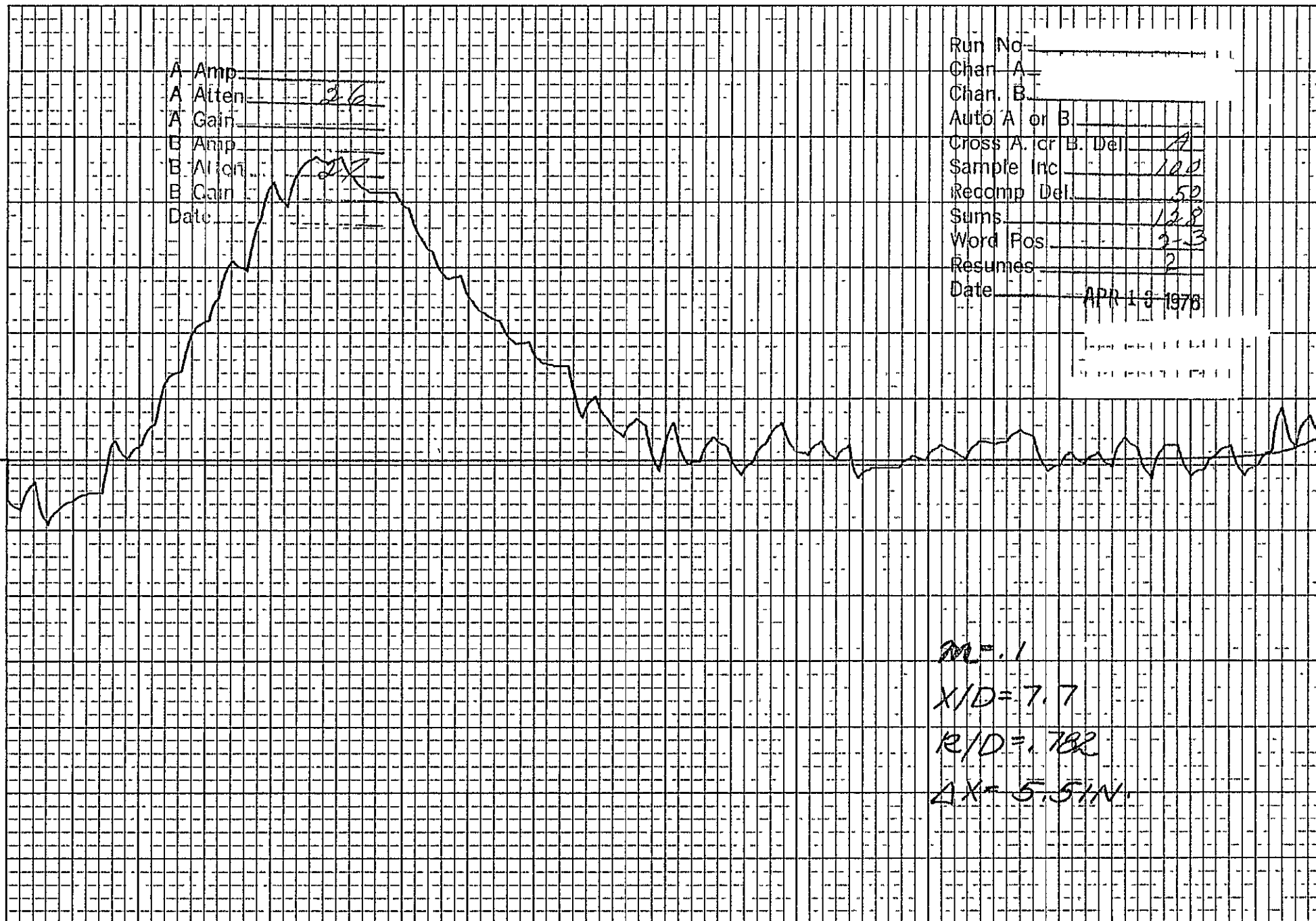


$M = .1$
 $X/D = 7.7$
 $R/D = .782$
 $\Delta X = 5.57N$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp
A Atten 26
A Gain
B Amp
B Atten 2X
B Gain
Date

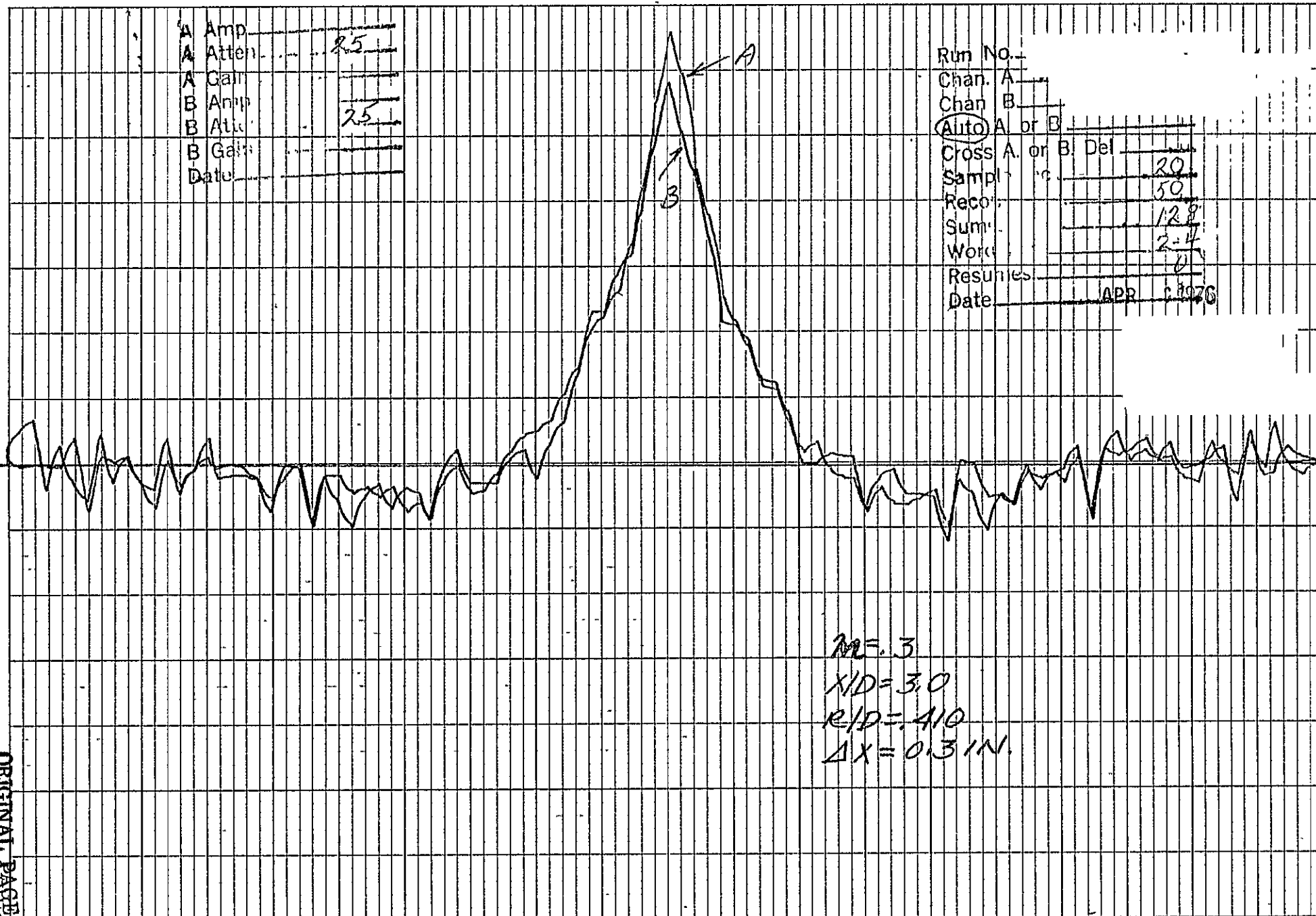
Run No.
Chan. A
Chan. B
Auto A or B
Cross A. or B. Del. 1
Sample Inc. 100
Recamp Del. 50
Sums 128
Word Pos. 3-3
Resumes 2
Date APR 13 1976



$m = .1$
 $X/D = 7.7$
 $R/D = .782$
 $\Delta X = 5.5 \text{ IN.}$

A Amp _____
A Atten. 25
A Gain _____
B Amp _____
B Atten. 25
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
(Auto) A or B _____
Cross A. or B. Del. _____
Sample _____
Reco. 20
Sum. 50
Word 128
Resumes 2-4
Date APR 1 1976



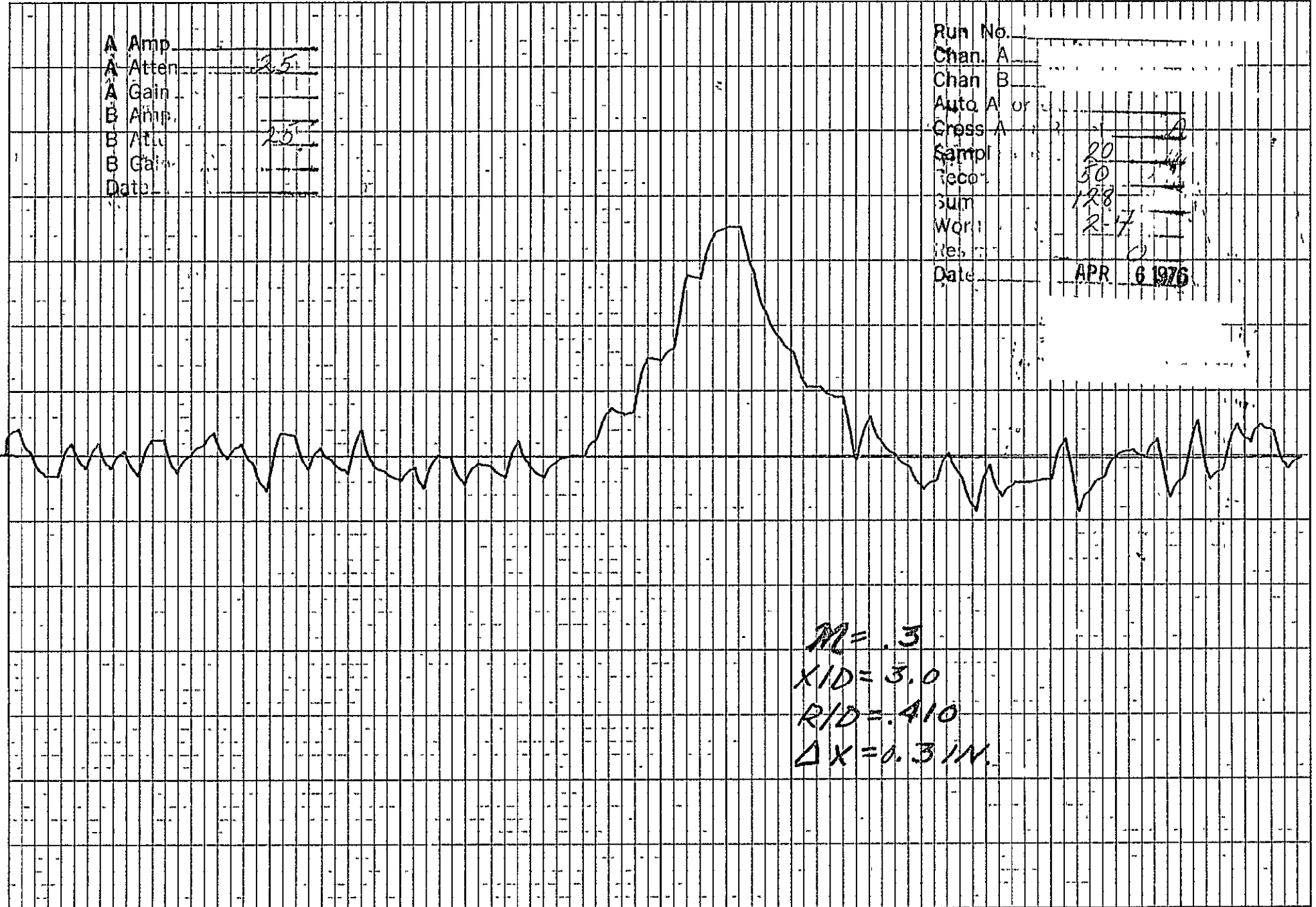
D-92

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten. 2.5
A Gain _____
B Amp. _____
B Atten. 2.5
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or _____
Cross A _____
Sample 20
Reco. 50
Sum 128
Wor. 2.7
Res. 0
Date APR 6 1976

D-93



$M = .3$
 $X/D = 3.0$
 $R/D = .410$
 $\Delta X = 0.31N$

A Amp
A Att: 2.5
A Gal:
B Att: 2.5
B Gal:
Date:

Run No.
Chan. A
Chan. B
Auto A. on: 13
Cross: 1
Sam: 20
Rec: 50
Sur: 128
Wor: 2-4
Res: 0
Date: APR 6 1976

D-94

PAGE 15
OF POOR QUALITY

$M = .3$
 $X/D = 3.0$
 $R/D = .410$
 $\Delta X = 1.8 IN.$

A Amp
A Attor 25
A Gal
B A
B A 25
B Gal
Date

Run No
Chan A
Chan B
Auto
Gro
Sat
T
SUI
Wo
Res
Date APR 6 1976

(1.7)

D-95

$M = .3$
 $X/D = 3.0$
 $R/D = .410$
 $\Delta X = 1.8 IN$

A Amp
A Atten 25
A Ga
B A
B Atten 25
B Ga
Date

Run No.
Chan. A
Chan. B
Auto A or B 3
Cross A or B
Sample 20
Rec 50
Sur 128
Word 2-4
Resin Co. 8
Date APR 6 1976

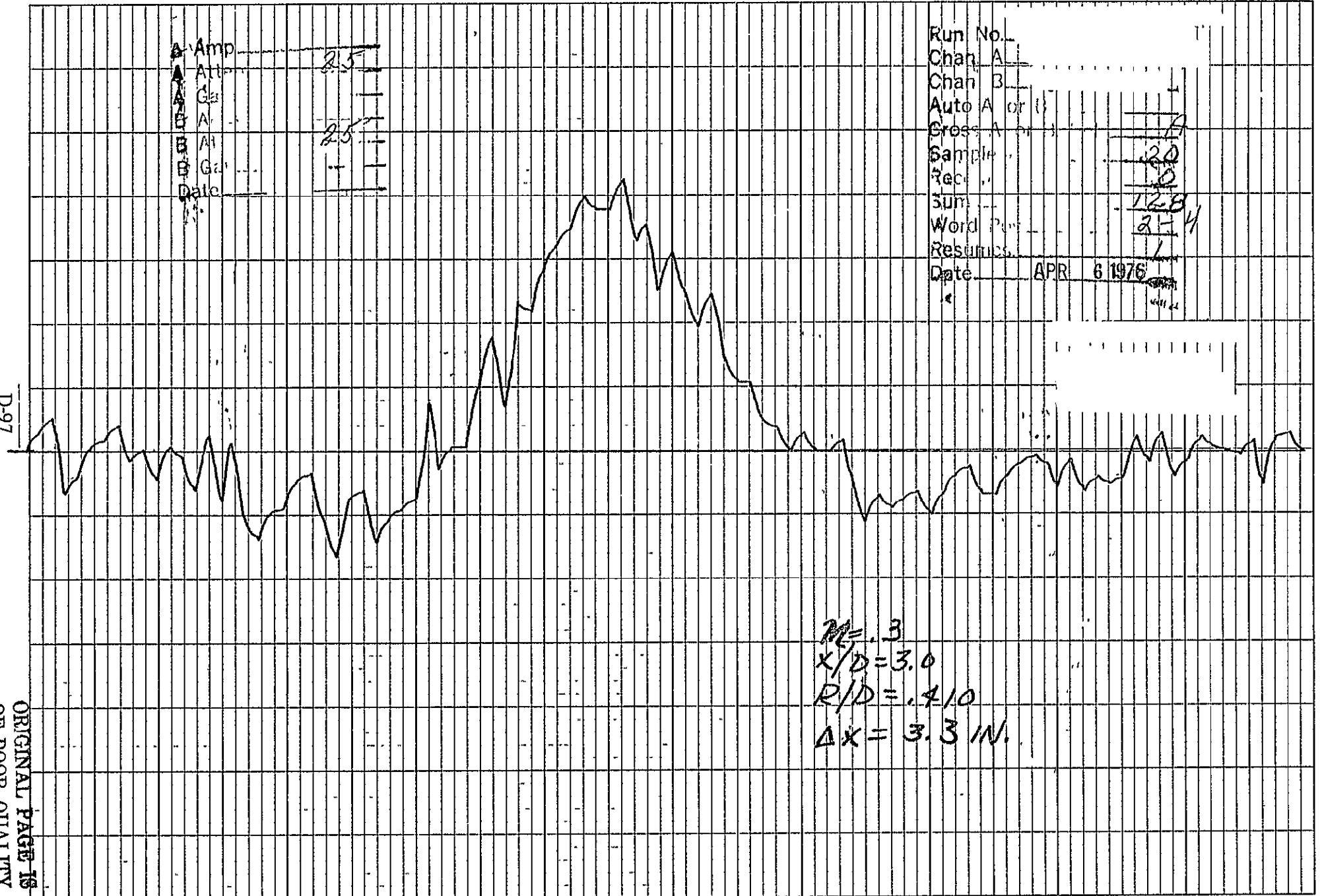
D-96

$M = .3$
 $X/D = 3.0$
 $R/D = .410$
 $\Delta X = 3.3 \text{ IN.}$

Amp 2.5
 Att 2.5
 Ga 2.5
 A 2.5
 M 2.5
 Ga 2.5
 Date 2.5

Run No. 1
 Chan. A 1
 Chan. B 1
 Auto A or B 1
 Cross A or B 1
 Sample 20
 Rec 10
 Sum 128
 Word Per 214
 Resumes 1
 Date APR 6 1976

D-97

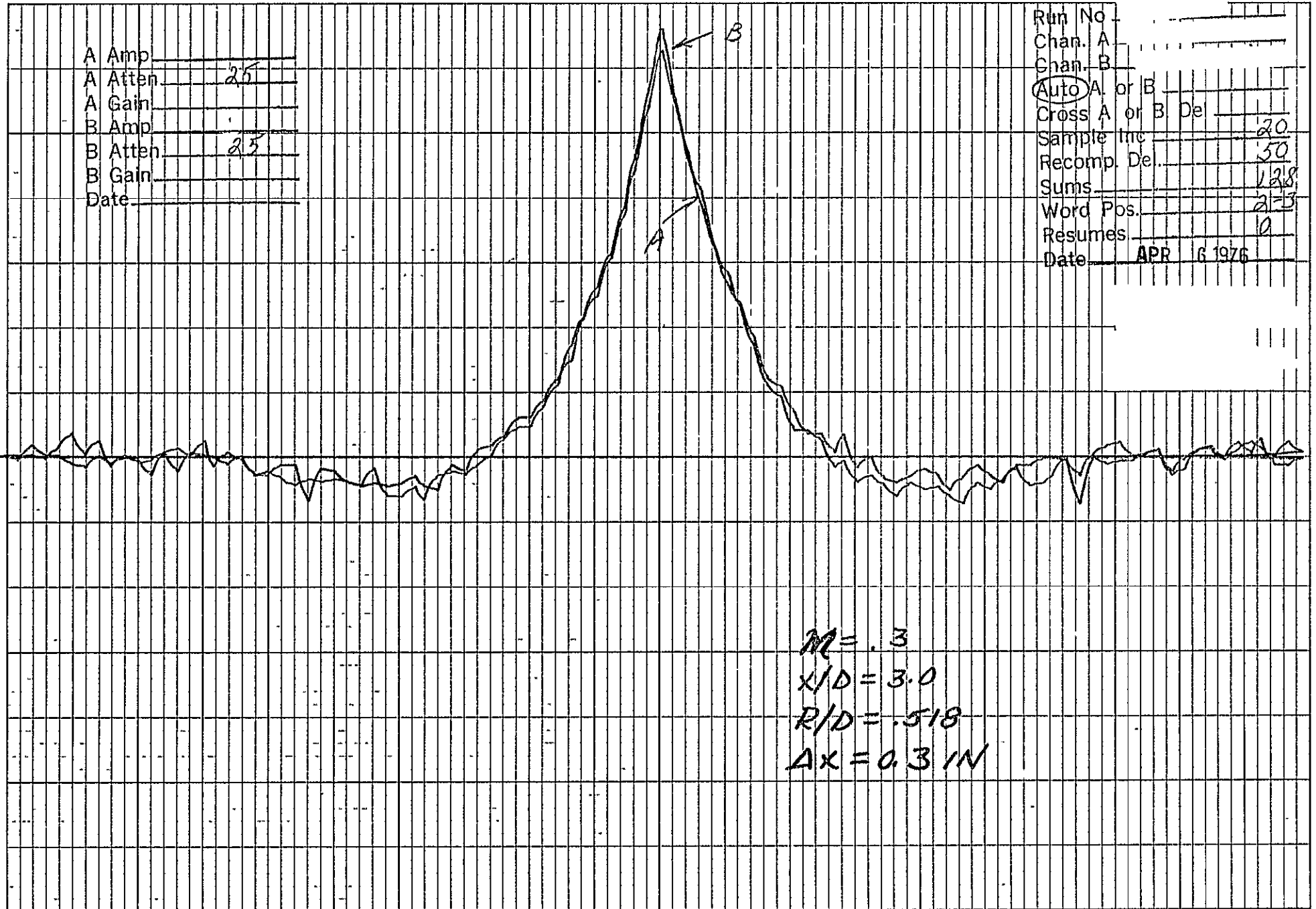


$M = .3$
 $x/D = 3.0$
 $R/D = .410$
 $\Delta x = 3.3 \text{ in.}$

A Amp _____
 A Atten 25
 A Gain _____
 B Amp _____
 B Atten 25
 B Gain _____
 Date _____

Run No. _____
 Chan. A _____
 Chan. B _____
 (Auto) A or B _____
 Cross A or B Del _____
 Sample Inc 20
 Recomp. Del 50
 Sums 128
 Word Pos. 213
 Resumes 0
 Date APR 6 1976

D-98



A Amp _____
A Atten 2.5
A Gain _____
B Amp _____
B Atten 2.5
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del A
Sample Inc. 2.0
Recomp Del. 5.0
Sums 128
Word Pos. 2-3
Resumes 0
Date APR 6 1976

D-99

$M = .3$
 $X/D = 3.0$
 $R/D = .518$
 $\Delta X = 0.3 \text{ IN.}$

A Amp _____
A Atten 25
A Gain _____
B Amp _____
B Atten 25
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B B
Cross A or B Del _____
Sample Inc. 20
Recomp Del. 50
Sums 128
Word Pos 2-3
Resumes 0
Date APR 6 1970

D-100

$M = .3$
 $X/D = 3.0$
 $R/D = .518$
 $\Delta X = 1.8 IN$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp.
A Atten. 23
A Gain
B Amp.
B Atten. 25
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A. or B.
Cross A. or B. Del. A
Sample inc. 20
Wave Del. 10
Units 128
Word Pos. 2-4
Assumes 1
Date APR 6 1976

D-101

$M = .3$
 $X/D = 3.0$
 $R/D = .518$
 $\Delta x = 1.81N$

A Amp _____
A Atten 25
A Gain _____
B Amp _____
B Atten 25
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. B
Cross A. or B. Del _____
Sample Inc 20
Recor. p. Del 50
Sums 128
Word Pos. 2-3
Resumes 1
Date APR 5 1976

D-102

$M = .3$
 $K/D = 3.0$
 $R/D = .518$
 $\Delta x = 3.3 IN.$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 25
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del 2
Sample Inc 20
Record Cl 0
Units 128
Word Pos 2-5
Resolves 0
Date APR 6 1976

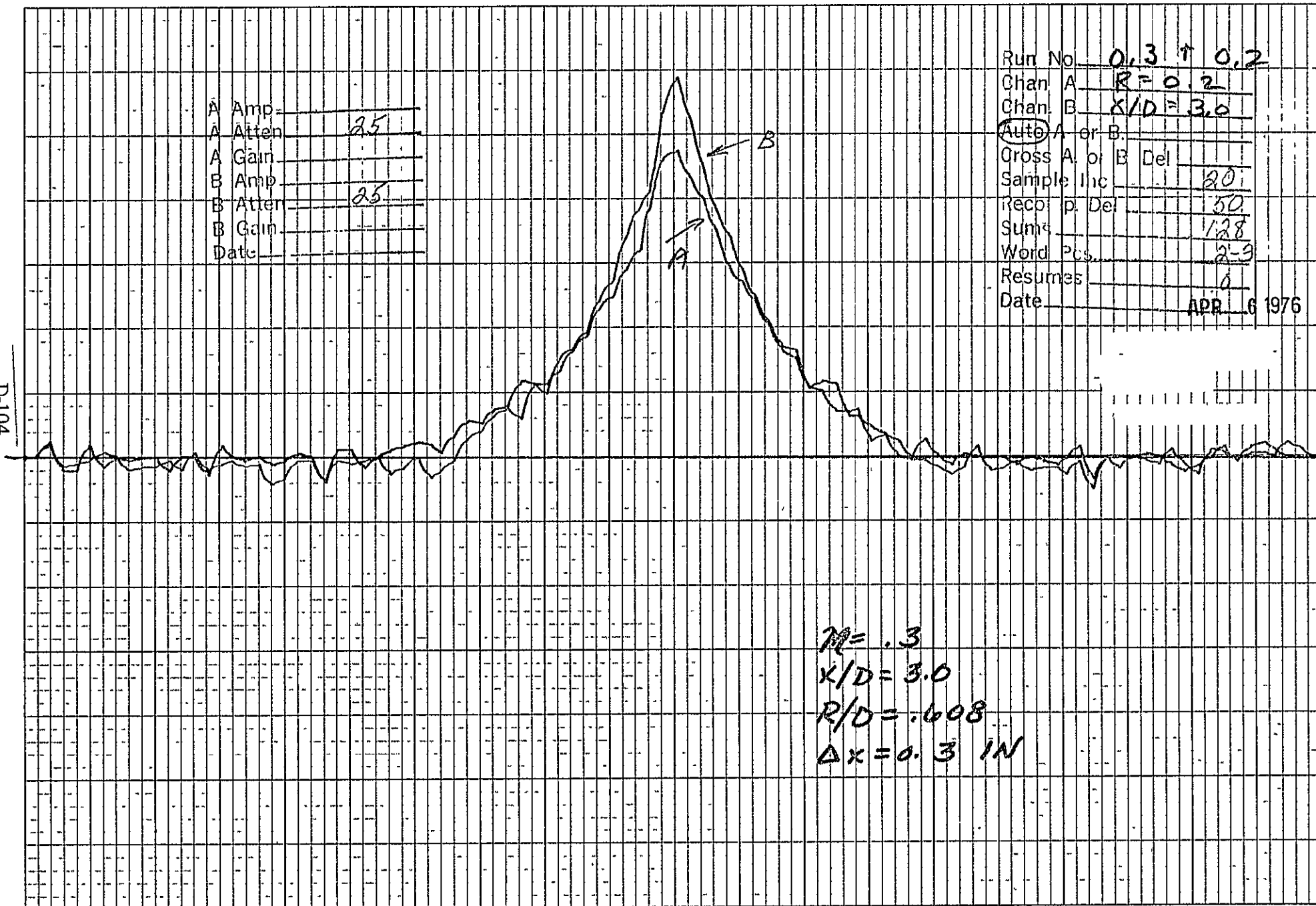
D-103

$M = .3$
 $X/D = 3.0$
 $R/D = .518$
 $\Delta X = 3.3 IN.$

A Amp _____
A Atten 25
A Gain _____
B Amp _____
B Atten 25
B Gain _____
Date _____

Run No. 0.3 ↑ 0.2
Chan. A R=0.2
Chan. B X/D=3.0
☒ Auto A or B.
Cross A. or B. Del _____
Sample Inc. 20
Reco. p. Del 50
Sum. 128
Word Pcs. 2-3
Resumes 0
Date APR 6 1976

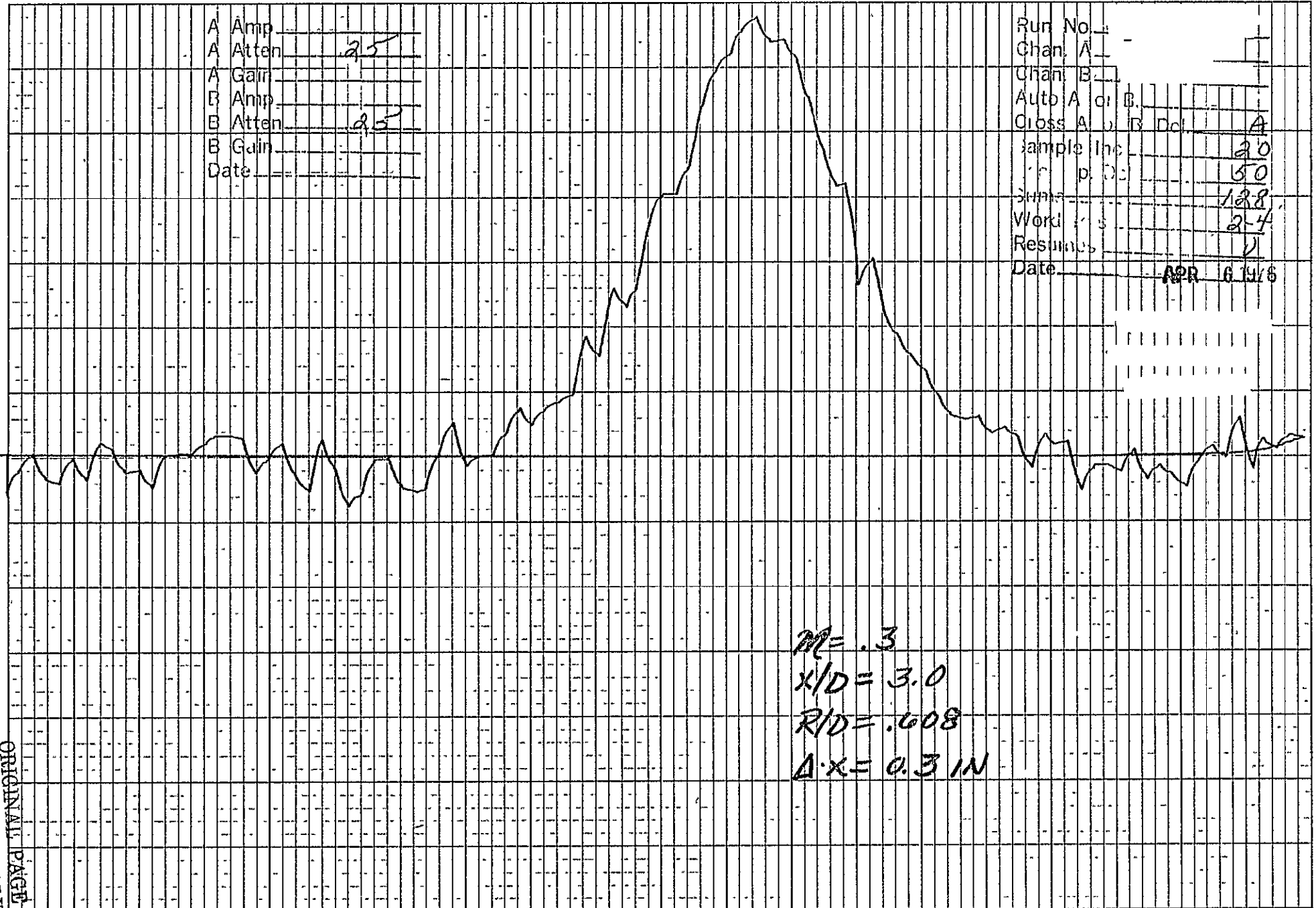
D-104



$M = .3$
 $X/D = 3.0$
 $R/D = .608$
 $\Delta x = 0.3 \text{ IN}$

A Amp _____
A Atten 25
A Gain _____
B Amp _____
B Atten 25
B Gain _____
Date _____

Run No. _____
Chan. A ☐ ☒
Chan. B ☐ ☒
Auto A or B. _____
Cross A or B Def. A
Sample Inc. 20
Scan Rate 50
Sigma 128
Word Size 2-4
Residuals 1
Date APR 6 1966



$M = .3$
 $X/D = 3.0$
 $R/D = .608$
 $\Delta X = 0.3 IN$

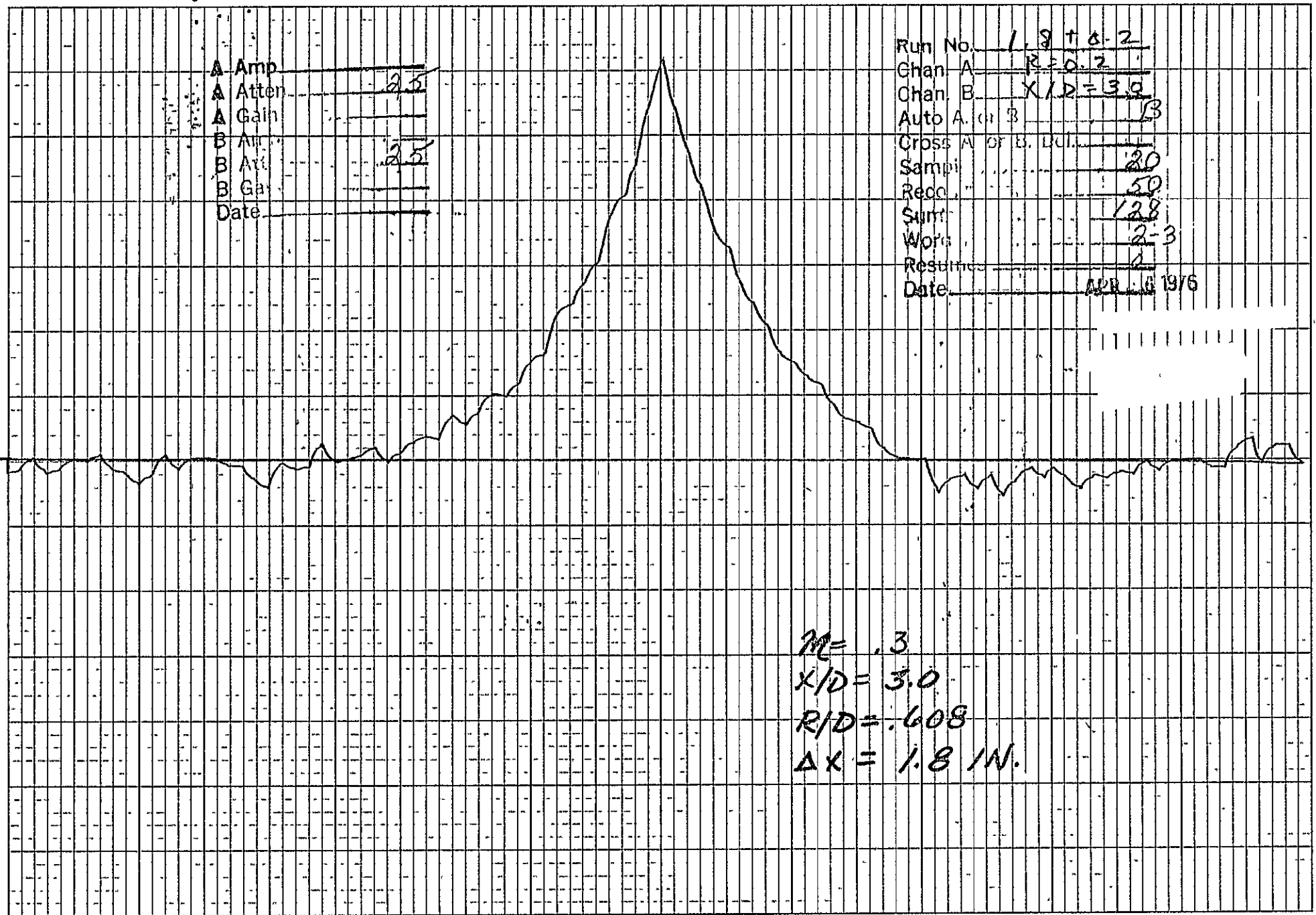
D-105

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
 A Atten. 2.5
 A Gain _____
 B Amp _____
 B Atten. 2.5
 B Gain _____
 Date _____

Run No. 1.9 + 0.2
 Chan. A R = 0.2
 Chan. B X/D = 3.0
 Auto A. or B. B
 Cross At. of B. Bul. _____
 Samp. 20
 Recc. 50
 Sum. 128
 Work. 2-3
 Rest. 2
 Date. APR 16 1976

D-106

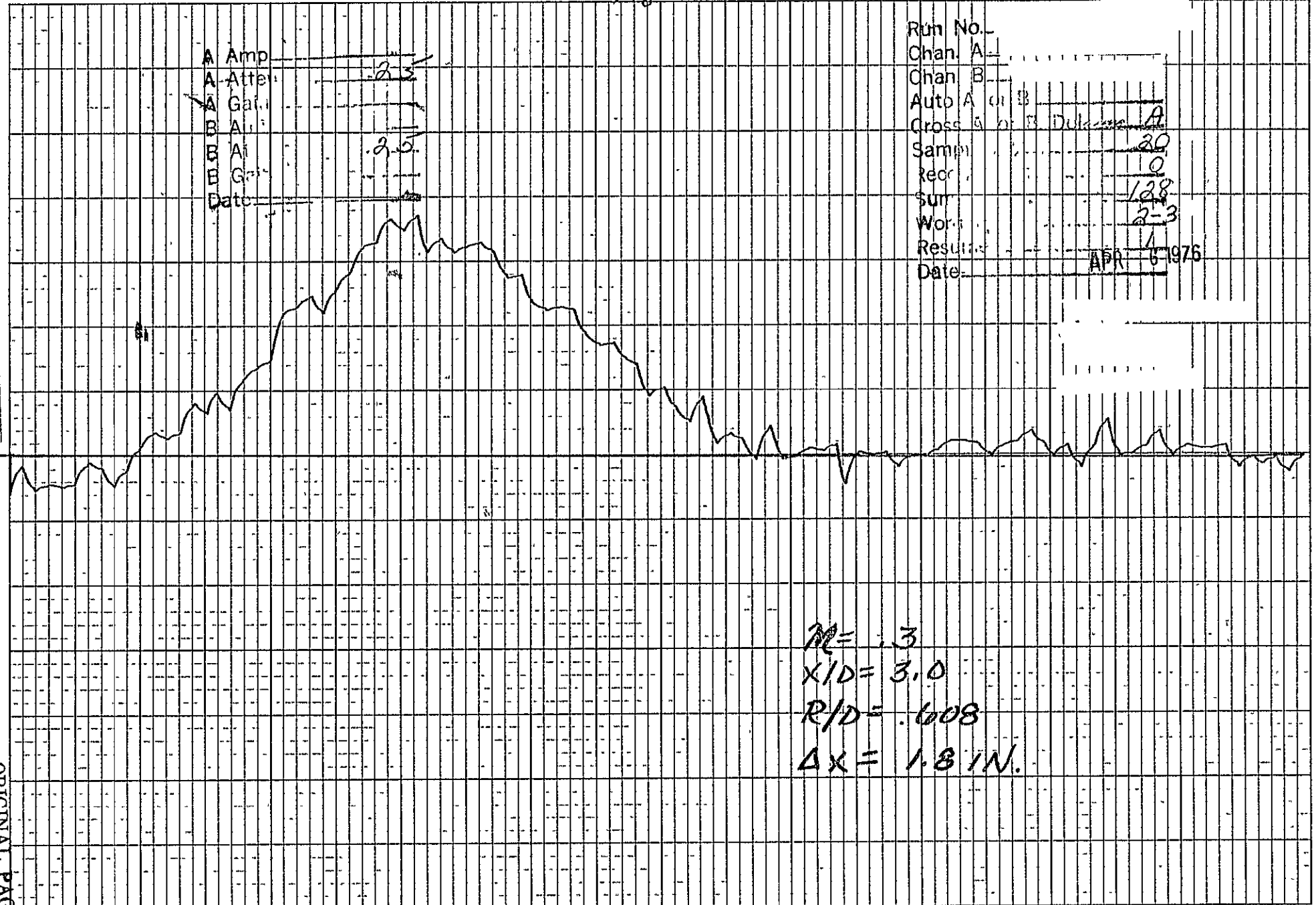


$M = .3$
 $X/D = 3.0$
 $R/D = .608$
 $\Delta X = 1.8 \text{ IN.}$

A Amp
A Attenuator 2.5
A Gain 2.5
B Attenuator
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A or B
Cross A or B A
Sample 20
Recr. 0
Sum 128
Wor. 2-3
Result 1
Date APR 6 1976

D-107

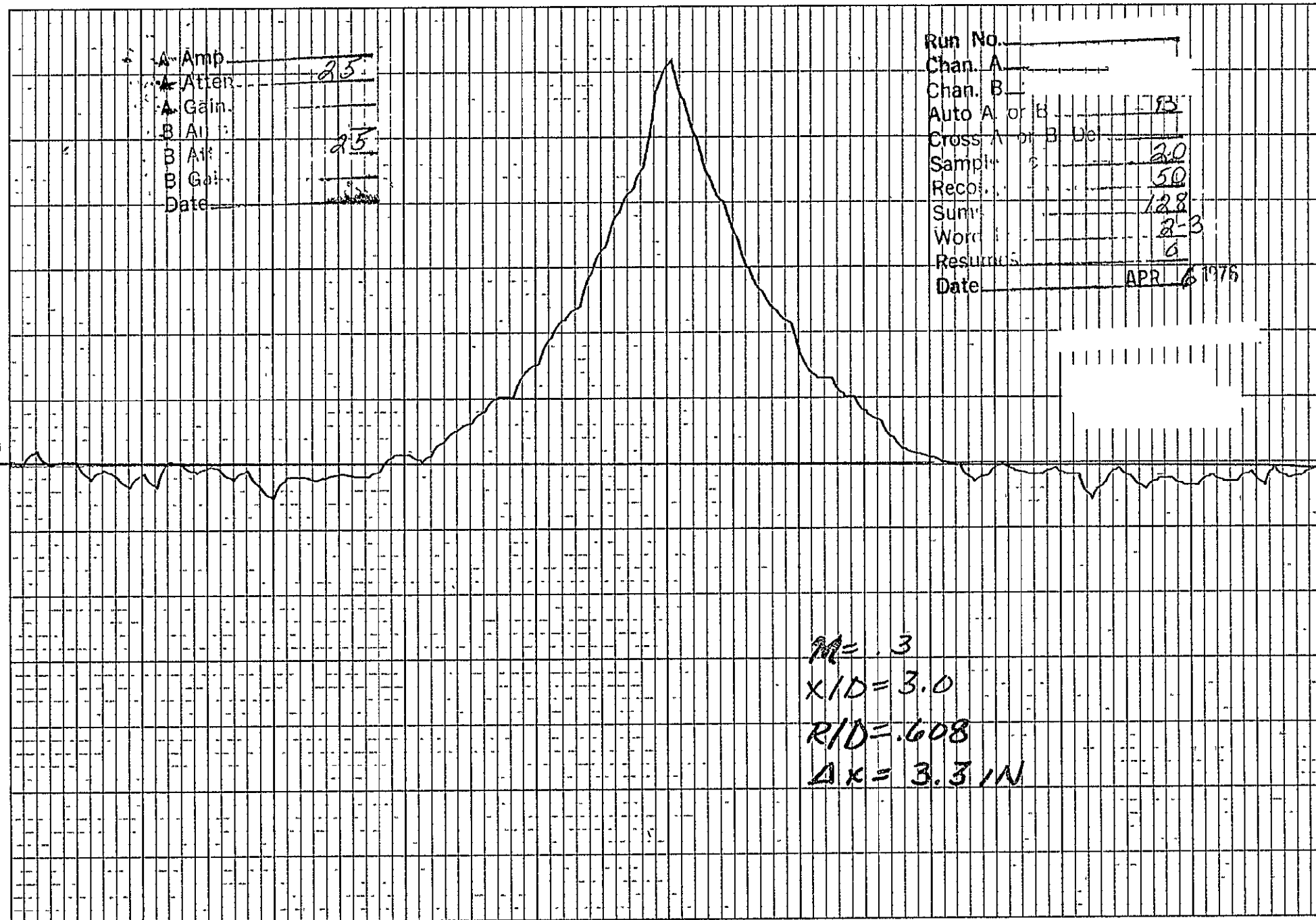


$M = .3$
 $X/D = 3.0$
 $R/D = .608$
 $\Delta X = 1.8 \text{ IN.}$

A Amp _____
A Atten. 25
A Gain. _____
B Atten. 25
B Gain. _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B 75
Cross A or B Del _____
Sample 2.0
Recon. 50
Summ. 128
Word 2-3
Residuals 6
Date APR 6 1976

D-108

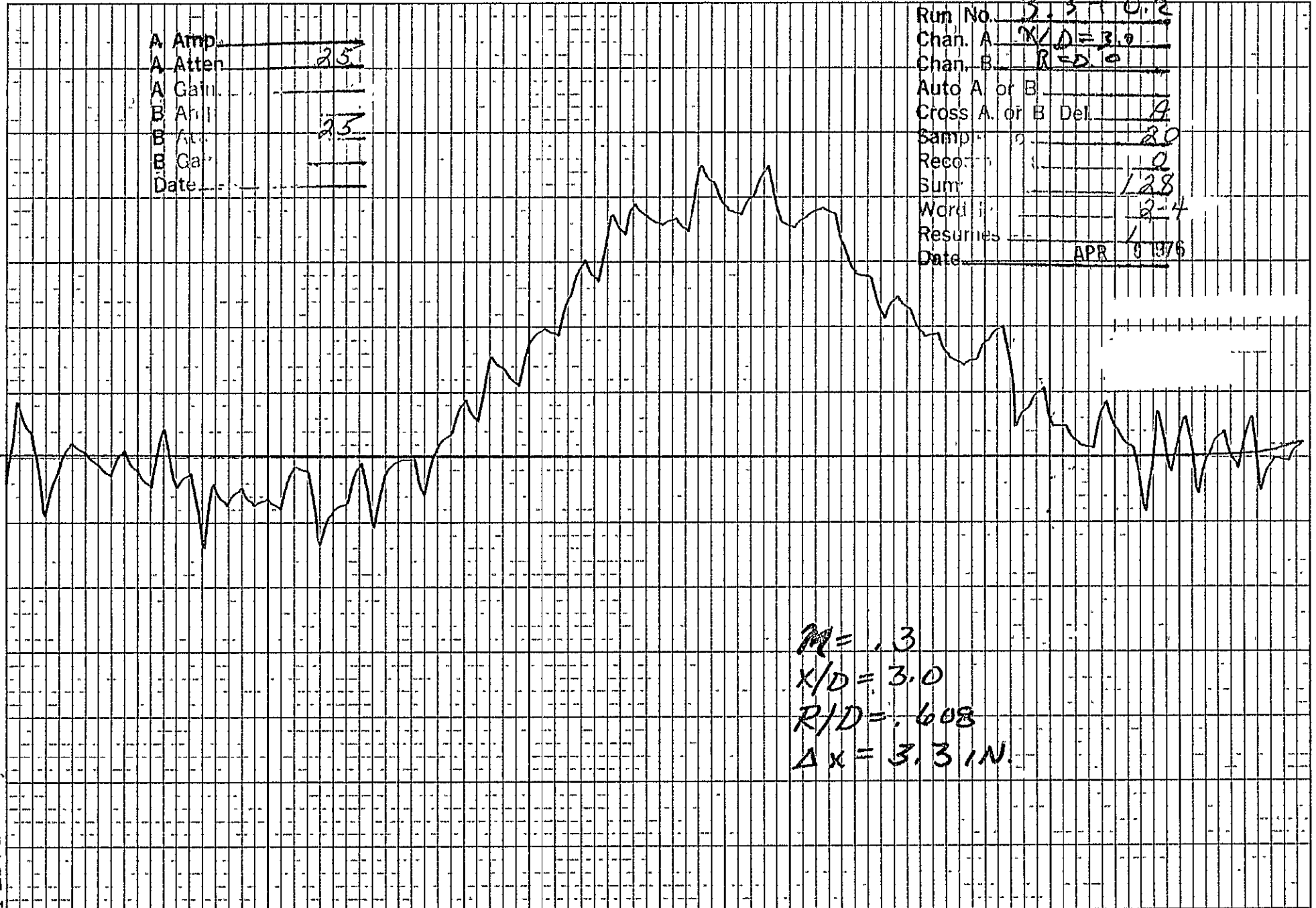


$M = .3$
 $X/D = 3.0$
 $R/D = .608$
 $\Delta x = 3.3 IN$

A Amp. _____
A Atten. 25
A Gain. _____
B Atten. _____
B Gain. 25
Date _____

Run No. 3.3 - 0.2
Chan. A X/D = 3.0
Chan. B R/D = 0.0
Auto A or B _____
Cross A. or B Del. 0
Sample _____
Recon. _____
Sum 1.28
Word _____
Resumes 1
Date APR 10 1976

D-109

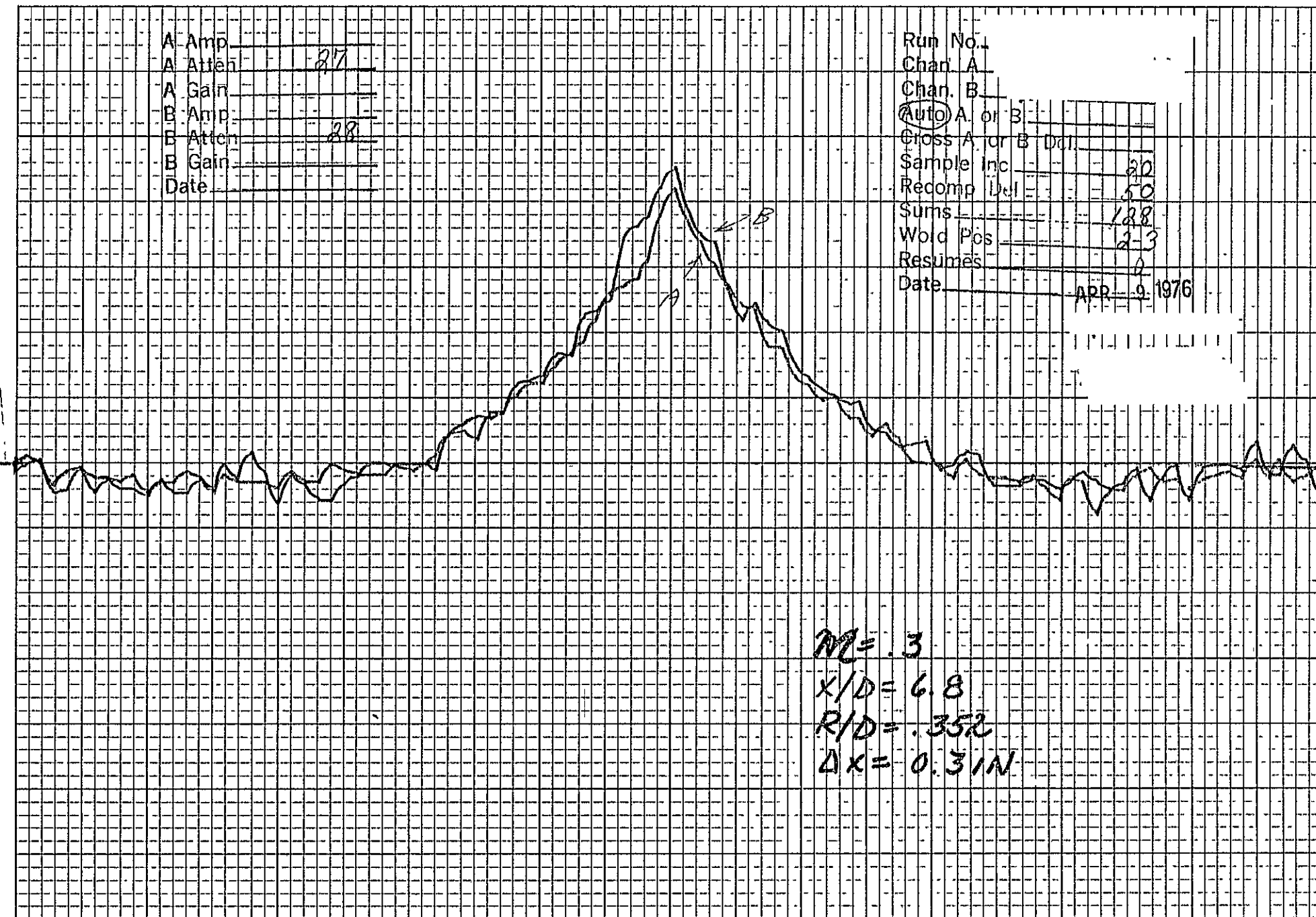


$M = .3$
 $X/D = 3.0$
 $R/D = .608$
 $\Delta x = 3.3 \text{ IN.}$

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 28
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
(Auto) A. or B. _____
Cross A. or B. Del. _____
Sample Inc. 20
Recomp Del. 50
Sums 188
Word Pcs 2-3
Resumes 0
Date APR 9 1976

D-110

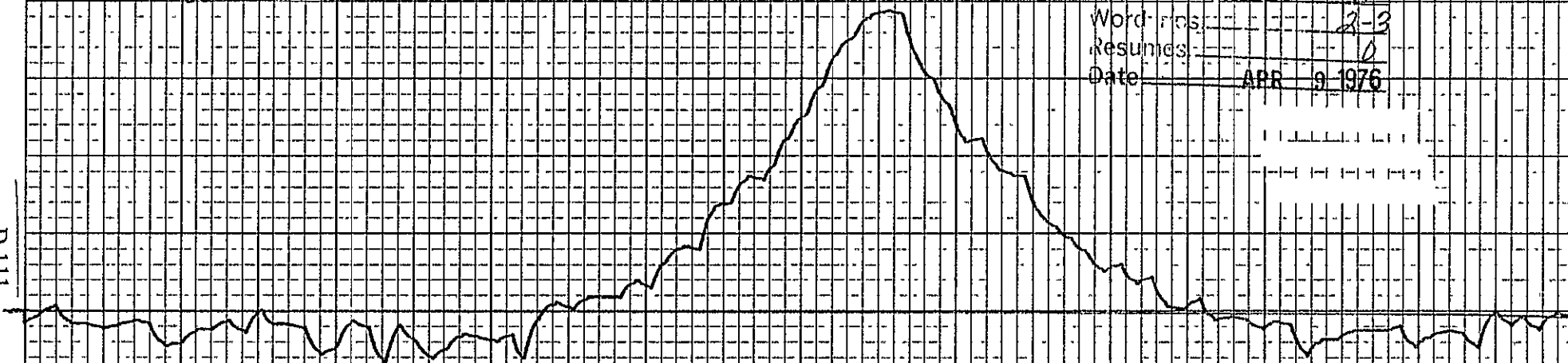


$M = .3$
 $X/D = 6.8$
 $R/D = .352$
 $\Delta X = 0.31N$

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 28
B Gain _____
Date _____

Run No: _____
Chan: A: _____
Chan: B: _____
Auto: A or B: _____
Cross A. or B. Del: 4
Sample Inc: 20
Recor'd. P. H: 50
Sums: 128
Word: res: 2-3
Resumes: 0
Date: APR 9 1976

D-111



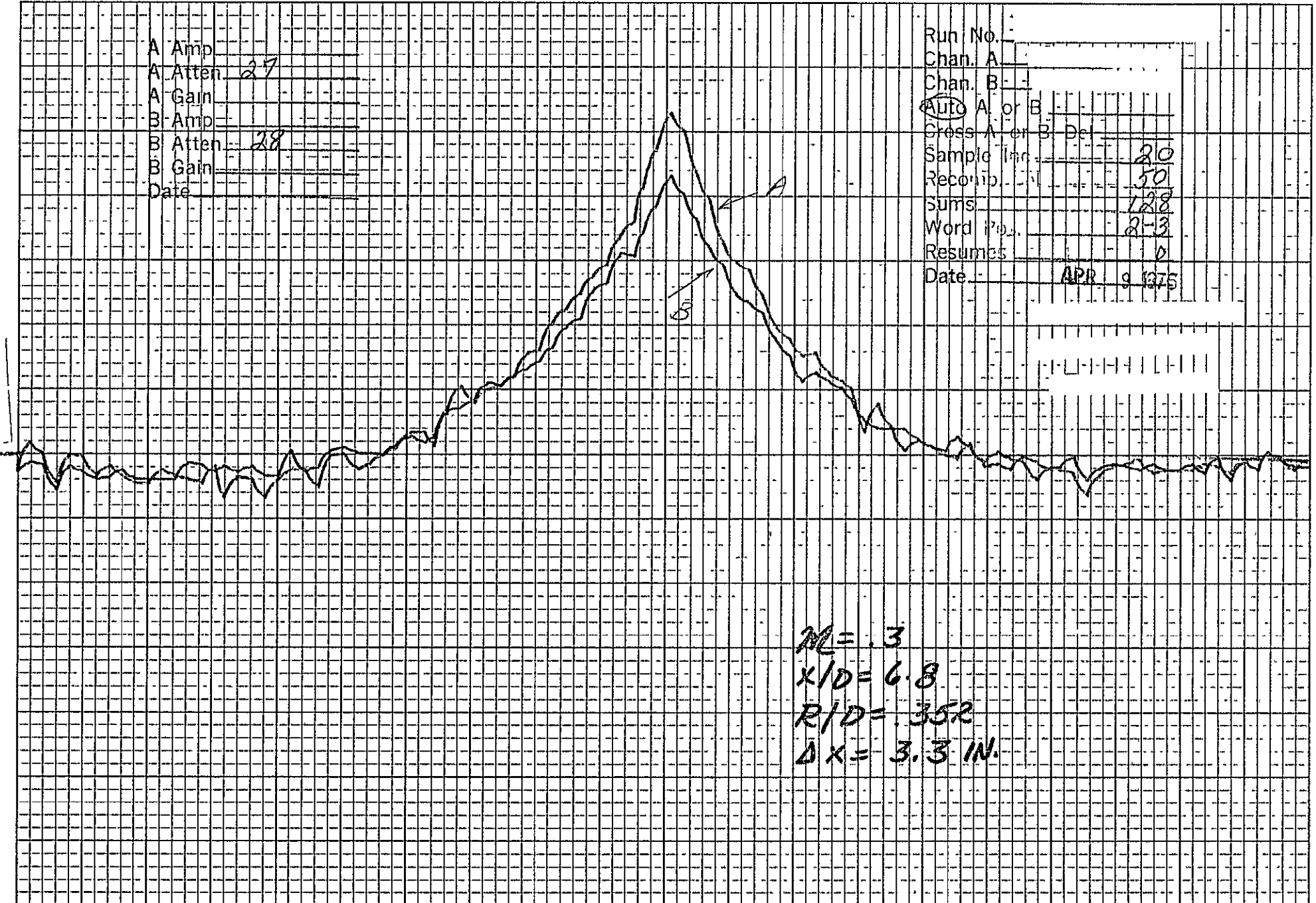
$M = .3$
 $X/D = 6.8$
 $R/D = .352$
 $\Delta x = 0.3 IN$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp
A Atten 27
A Gain
B Amp
B Atten 28
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A or B
Cross A or B Det
Sample In 20
Recon 50
Sums 128
Word 21-3
Resumes 0
Date APR 9 1975

D-112



$M = .3$
 $X/D = 6.8$
 $R/D = .352$
 $\Delta X = 3.3 \text{ IN.}$

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 28
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B A
Cross A. or B. Del. _____
Sample Inc. 50
Recomp. 50
Sums 128
Word Loo. 2.4
Resumes. 0
Date APR 9 1976

D-113

$M = .3$
 $X/D = 6.8$
 $R/D = .352$
 $\Delta X = 3.3 IN$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 28
B Gain _____
Date _____

Run No. _____
Chan A _____
Chan B _____
Auto A or B B
Cross A or B Del. _____
Sample Inc. 50
Recomp 50
Sum 138
Word Pos 2-3
Resumes 0
Date APR 9 1976

D-114

$M = .3$
 $X/D = 4.8$
 $R/D = .352$
 $\Delta X = 4.3 \text{ IN.}$

A Amp _____
A Atten 27
A Gain _____
B Amp _____
B Atten 28
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. A
Sample Inc. 30
Record Del. 0
Sum 128
Word Pos. 2-4
Resumes 2
Date APR 9 1976

D-115

$M = .3$
 $X/D = 6.8$
 $R/D = .352$
 $\Delta x = 6.3 \text{ IN.}$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp
A Atten 26
A Gain
B Amp
B Atten 26
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A or B A
Cross A. or B. De
Sample Inc 50
Recomp De 50
Sums 128
Word Pos 2-3
Resumes
Date APR 8 1976

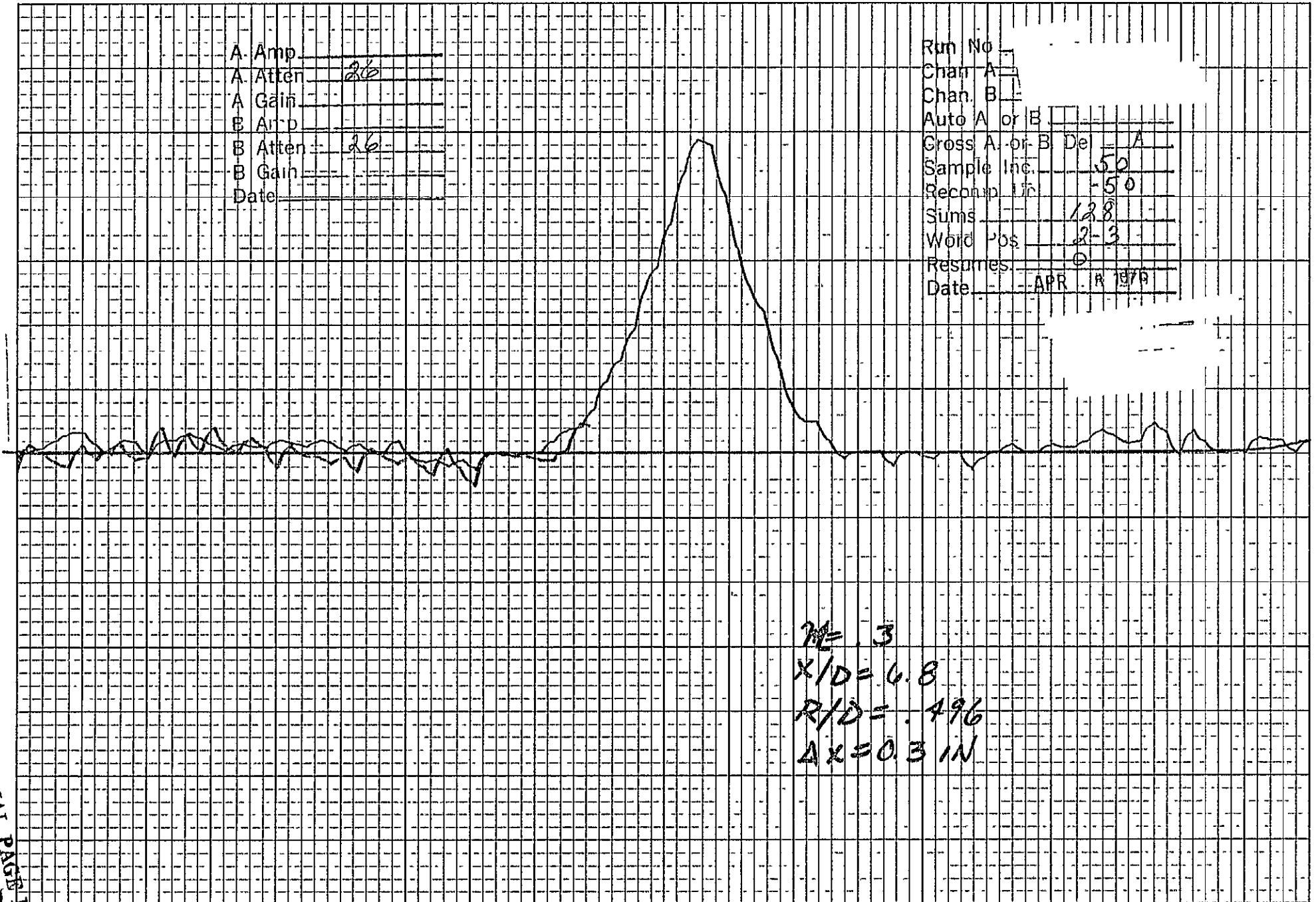
D-116

$M = .3$
 $X/D = 6.8$
 $R/D = .496$
 $\Delta X = 0.31N.$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

Run No _____
Chan A ☐
Chan B ☐
Auto A or B _____
Cross A. or B De A
Sample Inc. 50
Recomp. 50
Sums 128
Word Pos 2-3
Resumes 0
Date APR 18 1979

D-117

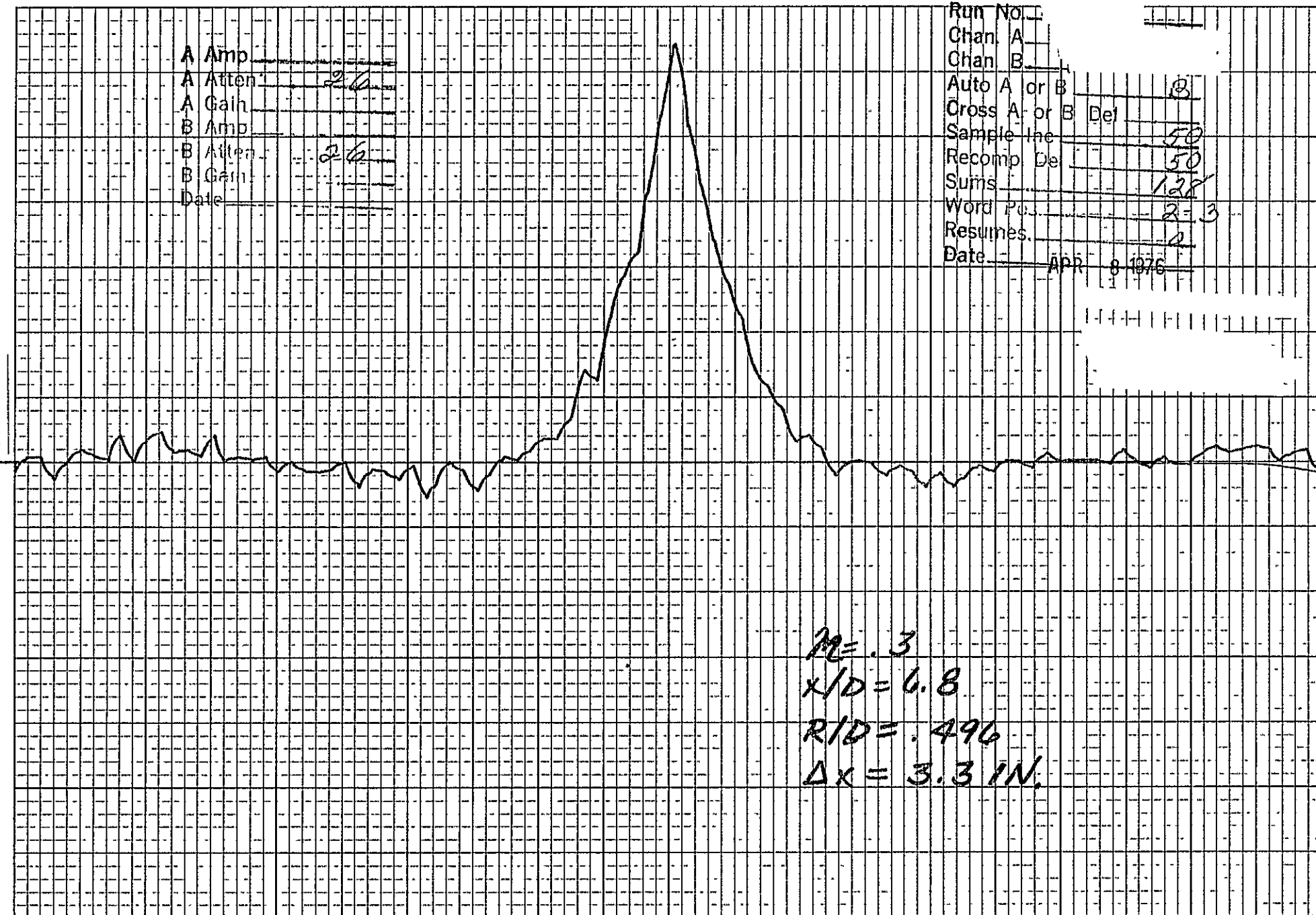


$M = 3$
 $X/D = 6.8$
 $R/D = .496$
 $\Delta X = 0.3 \text{ IN}$

A Amp _____
A Atten: 26
A Gain _____
B Amp _____
B Atten: 26
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B B
Cross A or B Del _____
Sample Inc 50
Recomp. Del 50
Sums 128
Word Po. 2-3
Resumes. 2
Date Apr 8 1976

D-118



$M = .3$
 $x/D = 6.8$
 $R/D = .496$
 $\Delta x = 3.3 \text{ IN.}$

A Amp _____
A Atten 2.6
A Gain _____
B Amp _____
B Atten 2.6
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. 1
Sample Inc. 50
Redcomp. Del. 50
Summ. 128
Word Pos. 3.4
Resumes 2
Date APR 8 1976

D-119

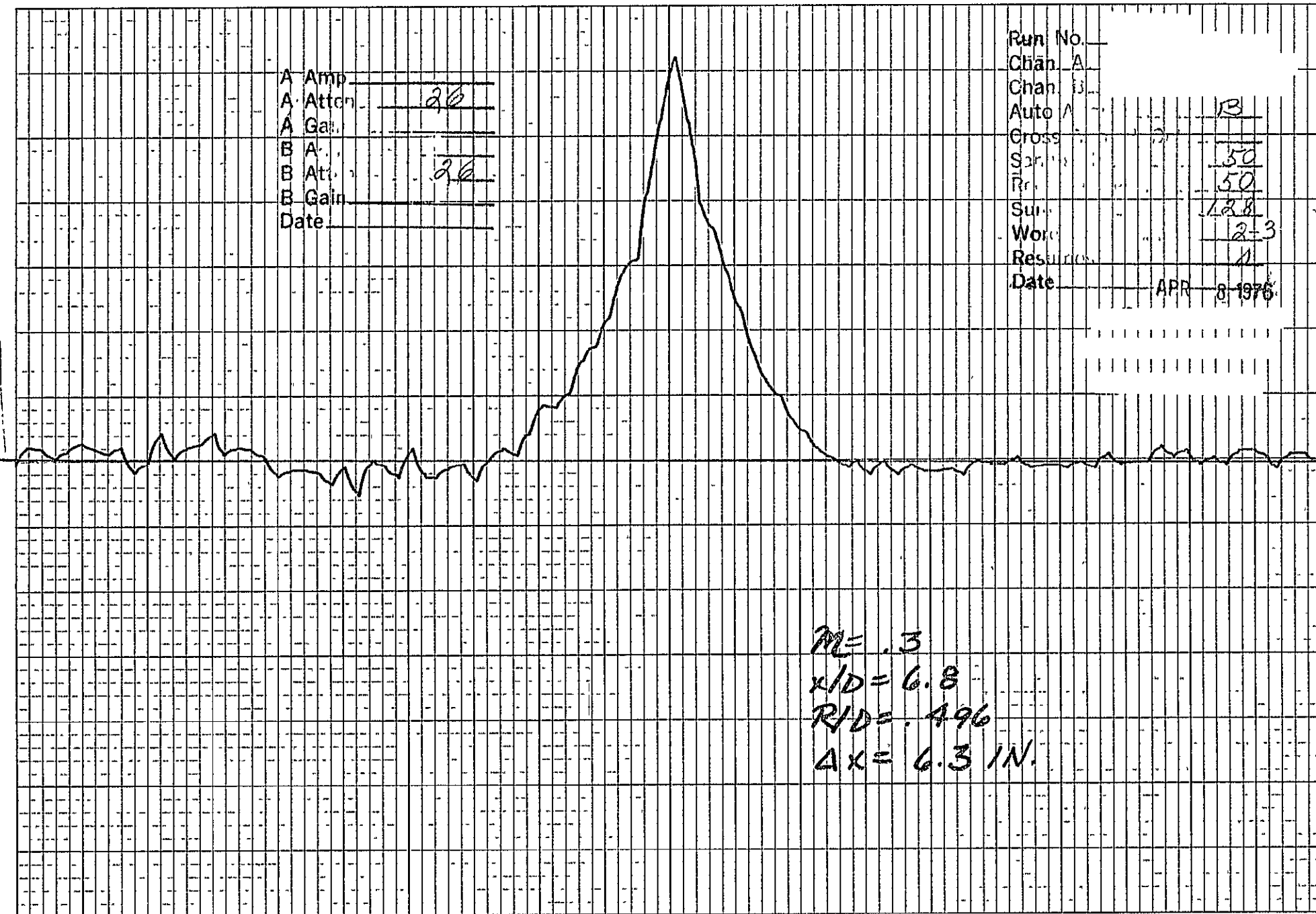
$M = .3$
 $X/D = 6.8$
 $R/D = .496$
 $\Delta X = 3.3 \text{ IN.}$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten. 20
A Gain _____
B A. _____
B Att. 20
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A B
Cross _____
Scrib. 50
Rr. 50
Sui. 12.8
Work 2-3
Res. 1
Date APR 8 1976

D-120



$M = .3$
 $x/D = 6.8$
 $R/D = .496$
 $\Delta x = 6.3 \text{ IN.}$

A Amp _____
 A Attenuator 24
 A Gain _____
 B A _____
 B Attenuator 26
 B Gain _____
 Date _____

Run No. _____
 Chan. A _____
 Chan. B _____
 Auto A B
 Cross 14
 S.R. 50
 R 2
 Su 128
 Work 2-4
 Result 1
 Date APR 8 1978

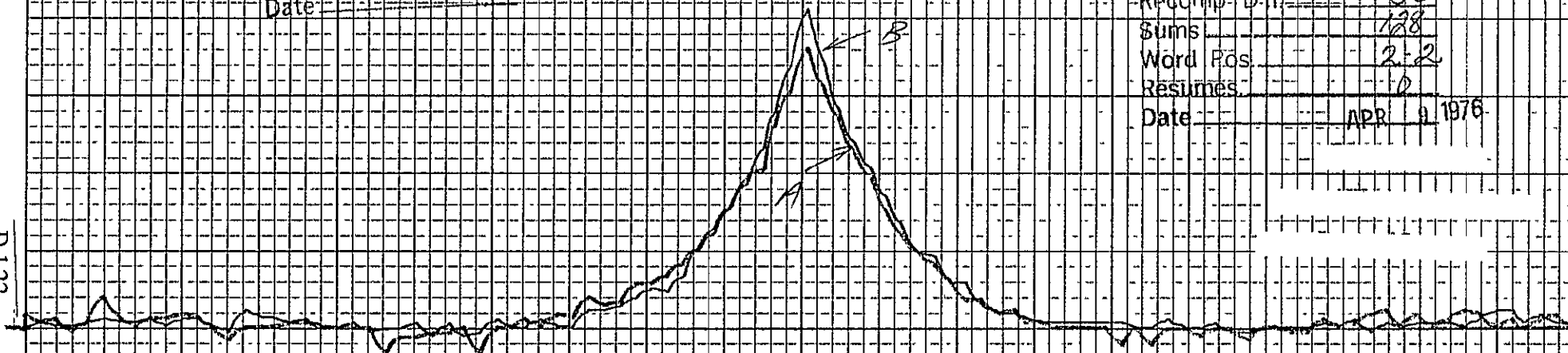
D-121

$M = 3$
 $x/D = 6.8$
 $R/D = .496$
 $\Delta x = 6.31N.$

A Amp _____
A Atten 25
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del. _____
Sample Inc. 50
Recomp. D.I. 50
Sums 128
Word Pos. 2.2
Resumes 0
Date APR 9 1976

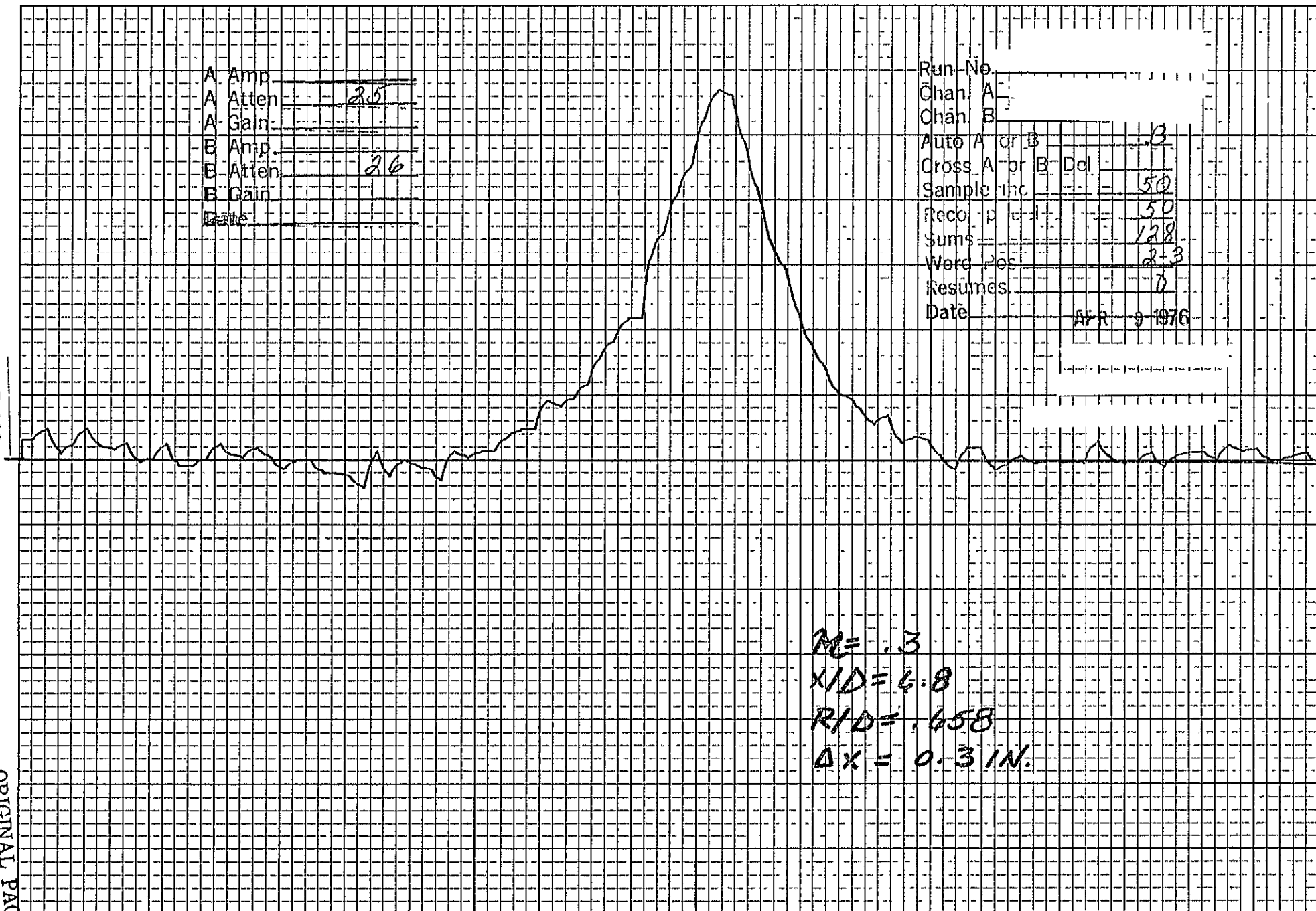
D-122



ME. 3
X/D = 6.8
R/D = .658
ΔX = 0.3 IN.

A. Amp. _____
A. Atten. 25
A. Gain: _____
B. Amp. _____
B. Atten. 26
B. Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B 3
Cross A or B Del _____
Sample Inc. 50
Reco. p. u. d. 50
Sums 128
Word Pos 2+3
Resumes 0
Date APR 9 1976

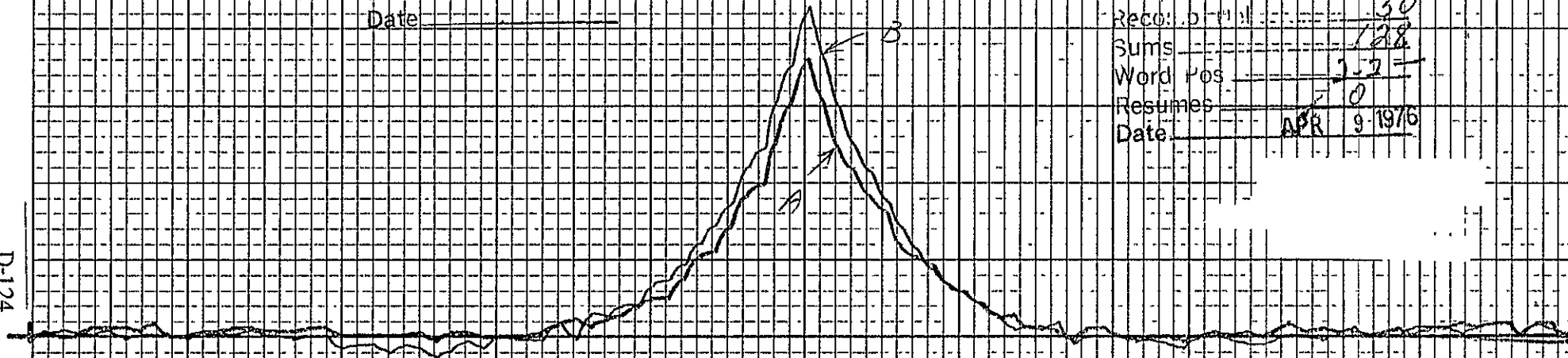


$M = .3$
 $X/D = 4.8$
 $R/D = .658$
 $\Delta X = 0.3 \text{ IN.}$

A Amp _____
A Atten 25
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del. 50
Sample I c. 50
Recor. I c. 50
Sums 128
Word Pos 252
Resumes 0
Date APR 9 1976

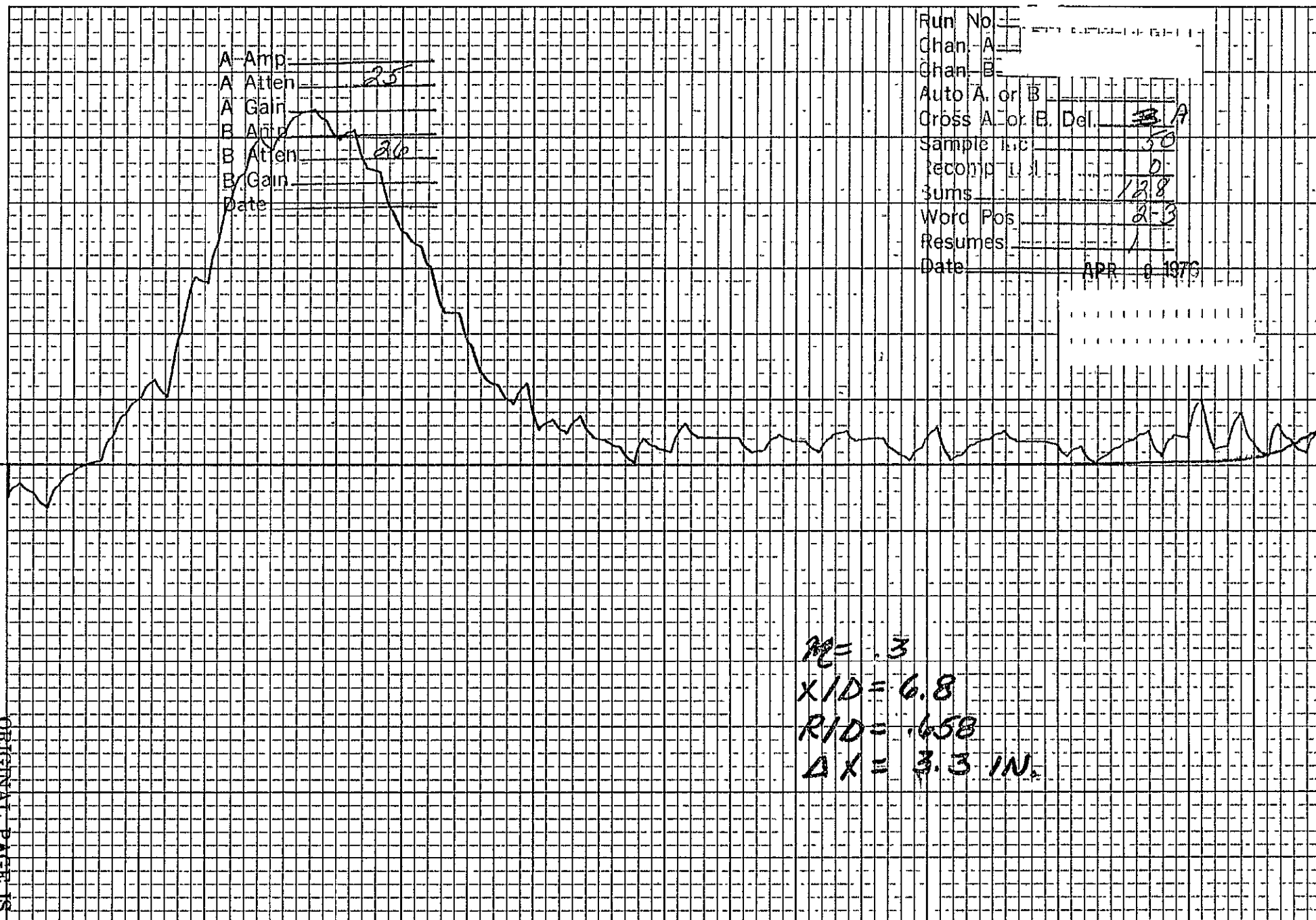
D-124



$M = 3$
 $X/D = 6.8$
 $R/D = .658$
 $\Delta X = 3.3 \text{ IN.}$

A Amp _____
A Atten _____ 25
A Gain _____
B Amp _____
B Atten _____ 26
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. 3 A
Sample Inc. 50
Recomp. L. L. 0
Sums 128
Word Pos. 2-3
Resumes 1
Date APR 8 1976



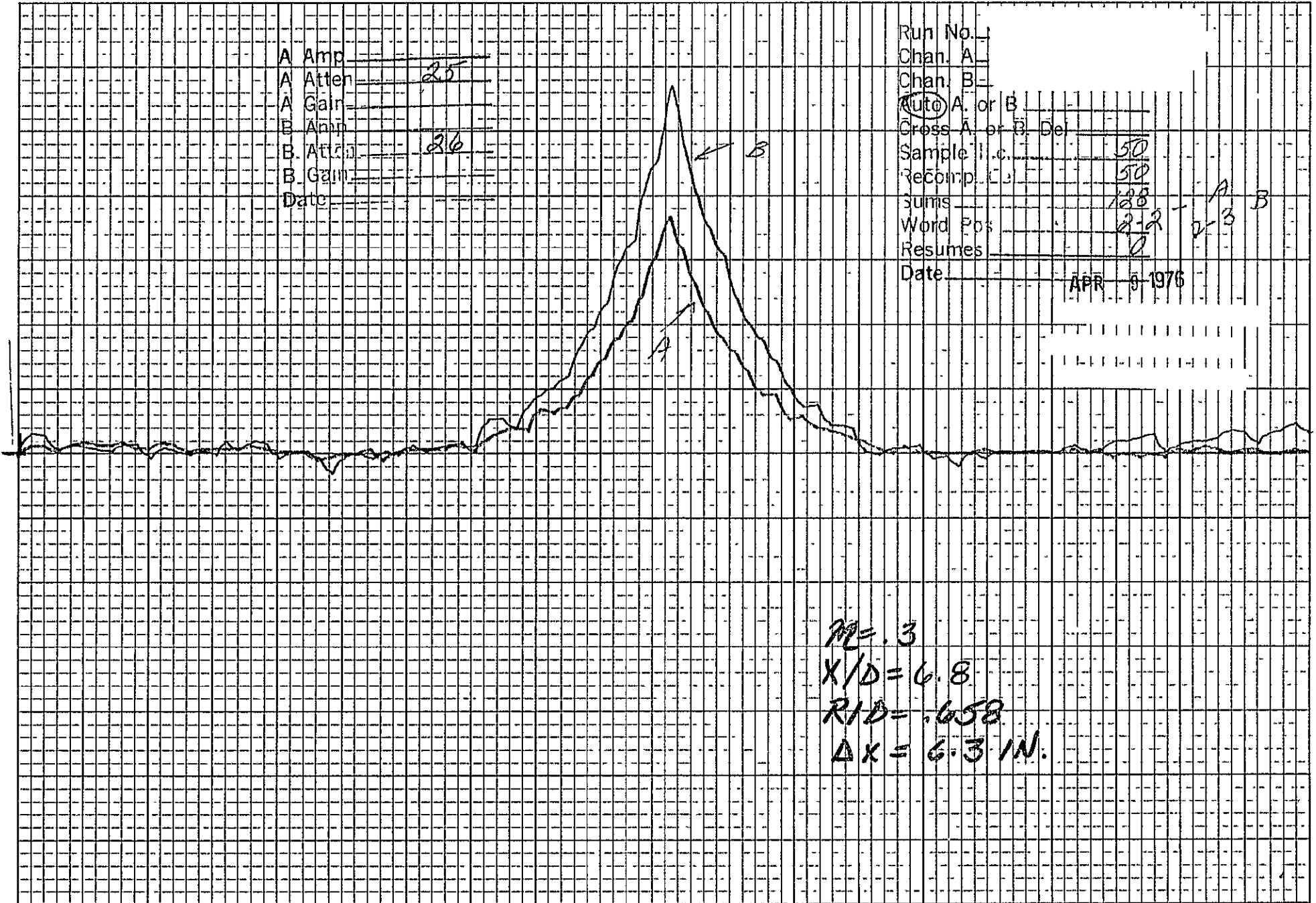
D-125

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 25
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
☒ Auto A. or B _____
Cross A. or B. Del _____
Sample I.c. 50
Recomp. C. 50
Sums 128 - A B
Word Pos 2-2 - 2-3
Resumes 0
Date APR 8 1976

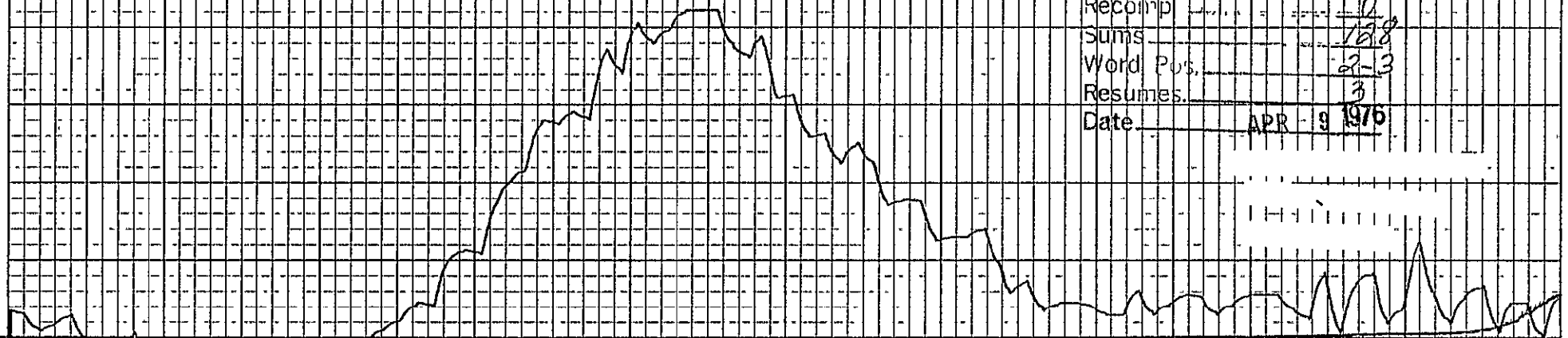
D-126



$M = .3$
 $X/D = 6.8$
 $R/D = .658$
 $\Delta X = 6.3 \text{ IN.}$

A Amp _____
A Atten 25
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Gross A - B Del 4
Sample No. 50
Recomp 0
Sums 128
Word Pos. 2-3
Resumes 3
Date APR 9 1976



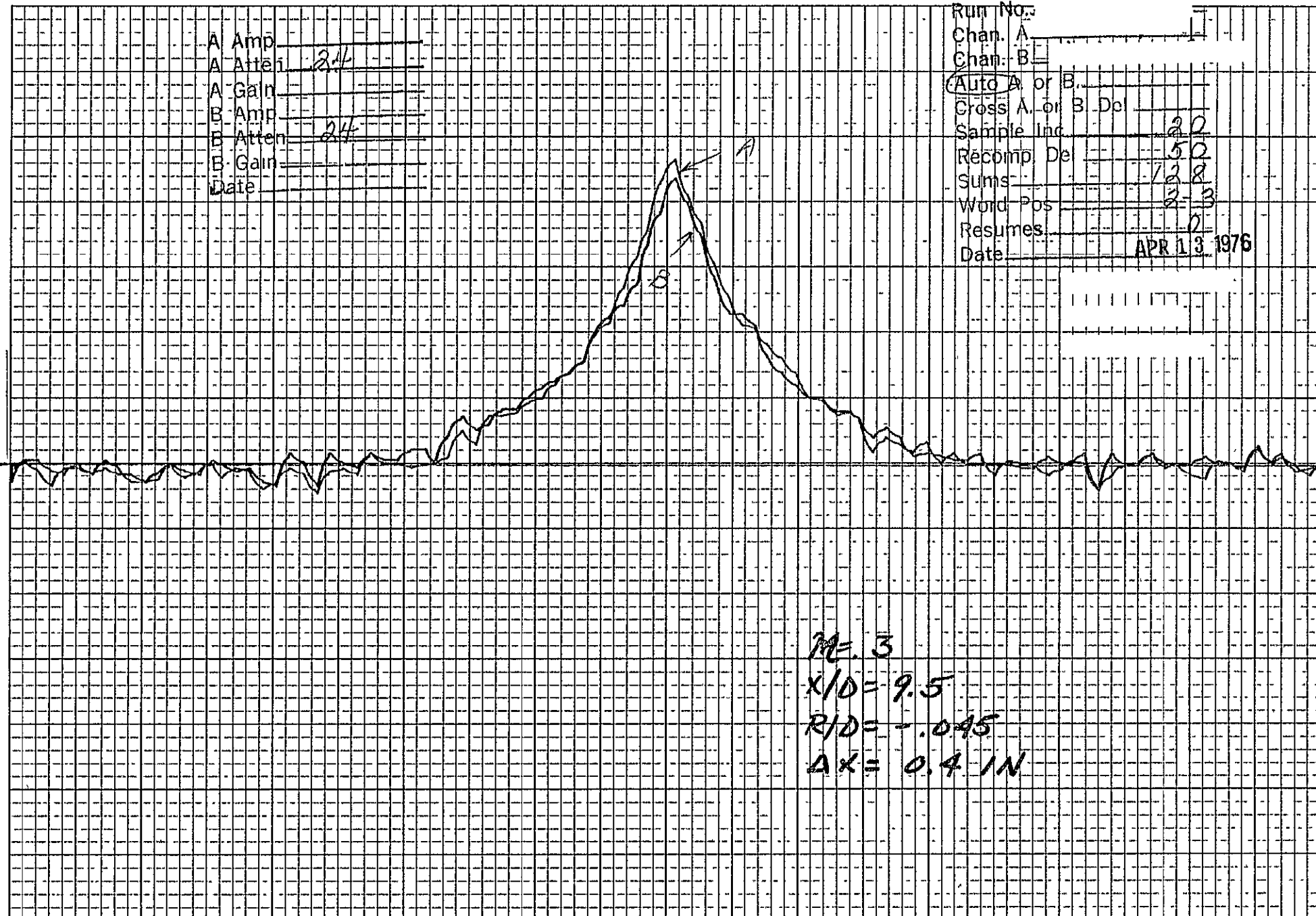
$M = 3$
 $X/D = 6.8$
 $R/D = 658$
 $\Delta x = 6.3 \text{ IN.}$

D-127

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Attēi 24
A Gain _____
B Amp _____
B Attēi 24
B Gain _____
Date _____

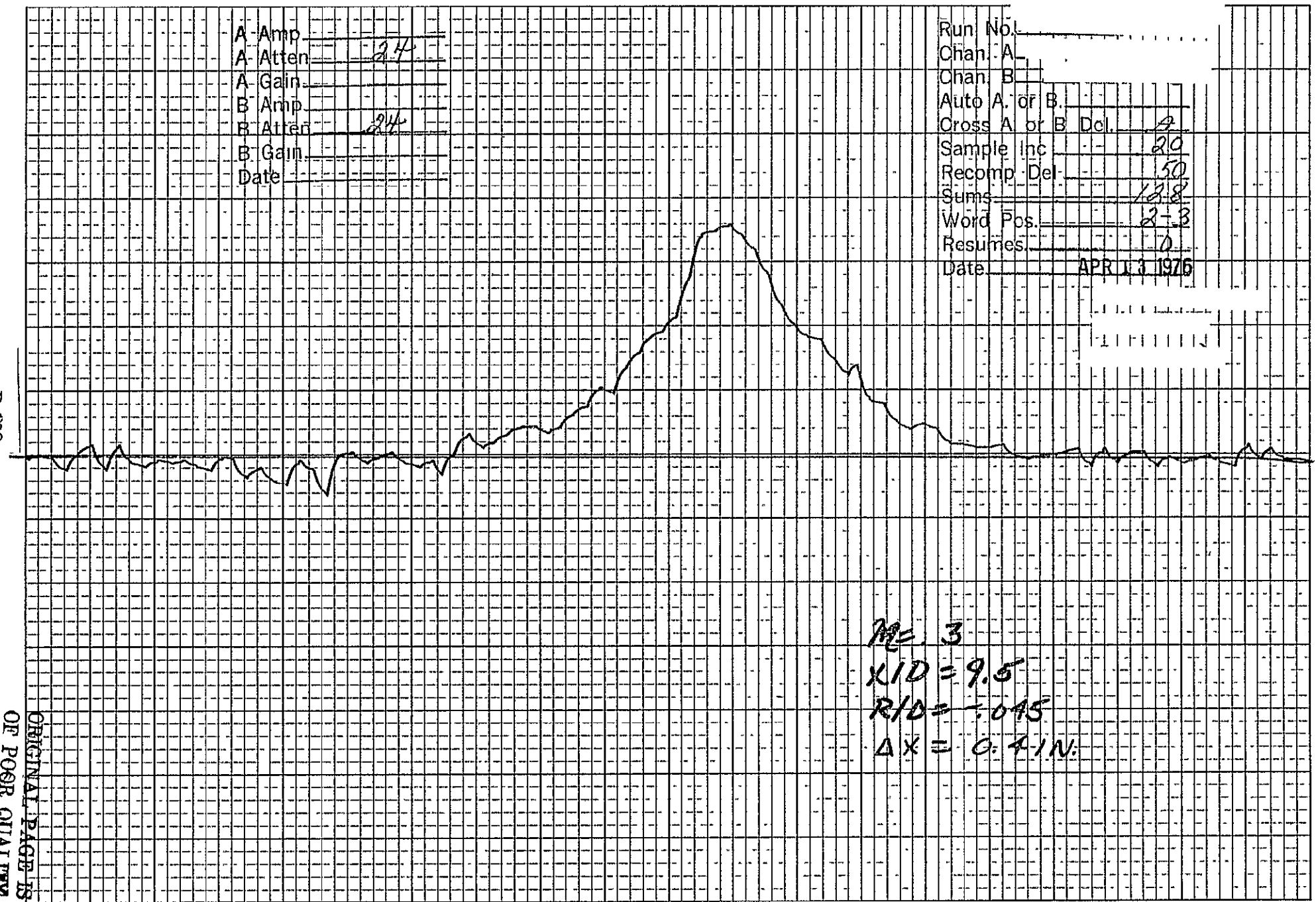
Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Gross A. or B. Do _____
Sample Inc. 22
Recomp. De 52
Sums 728
Word Pos 2-3
Resumes 0
Date APR 13 1976



ME. 3
X/D = 9.5
R/D = -.045
ΔK = 0.4 IN

A Amp _____
A Atten 24
A Gain _____
B Amp _____
B Atten 24
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A or B Del. 4
Sample Inc 20
Recomp Del 50
Sums 12.8
Word Pos. 2-3
Resumes 0
Date APR 13 1976



ME 3
X/D = 9.5
R/D = 1.045
 $\Delta X = 0.71N$

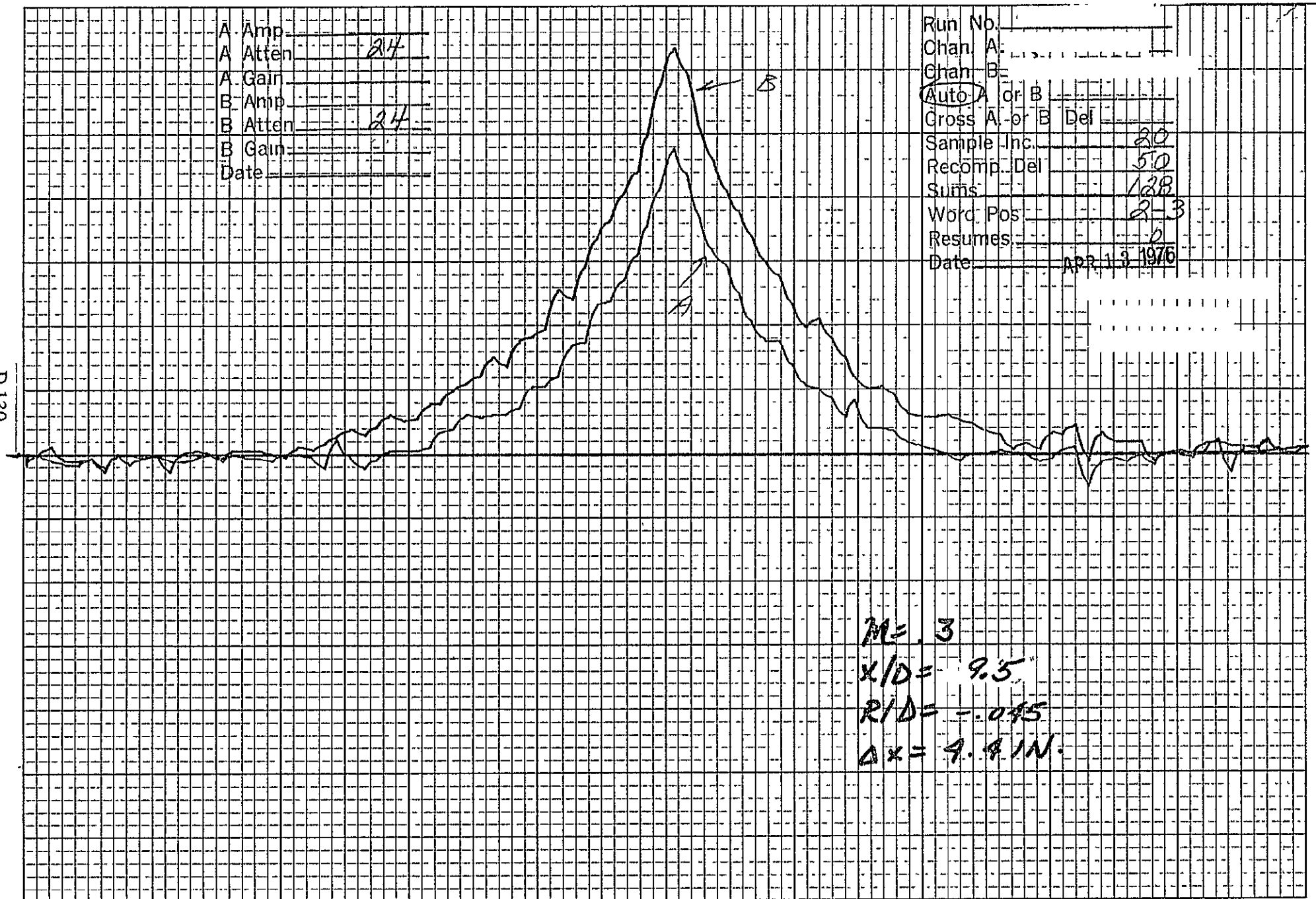
D-129

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 24
A Gain _____
B Amp _____
B Atten 24
B Gain _____
Date _____

Run No. _____
Chan. A. _____
Chan. B. _____
Auto A or B _____
Cross A. or B Del _____
Sample Inc. 20
Recomp. Del 50
Sums 128
Word Pos 2-3
Resumes 0
Date Apr 13 1976

D-130

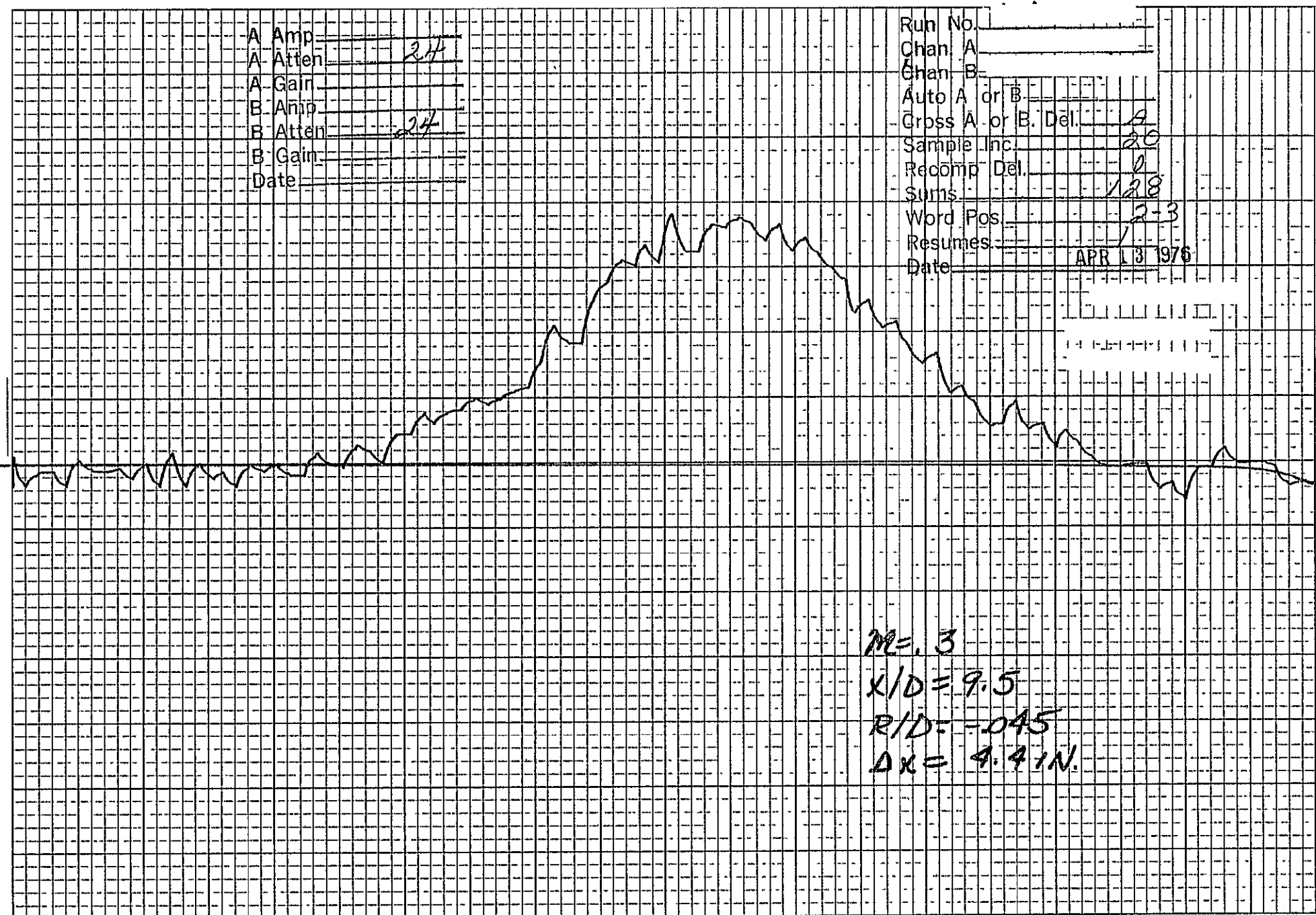


$M = 3$
 $X/D = 9.5$
 $R/D = -0.45$
 $\Delta x = 9.91N$

A Amp _____
 A Atten _____ 24
 A Gain _____
 B Amp _____
 B Atten _____ 24
 B Gain _____
 Date _____

Run No. _____
 Chan. A _____
 Chan. B _____
 Auto A or B _____
 Gross A or B. Del. _____ A
 Sample Inc. _____ 20
 Recomp Del. _____ 0
 Sums _____ 128
 Word Pos _____ 2-3
 Resumes _____ 1
 Date _____ APR 13 1976

D-131

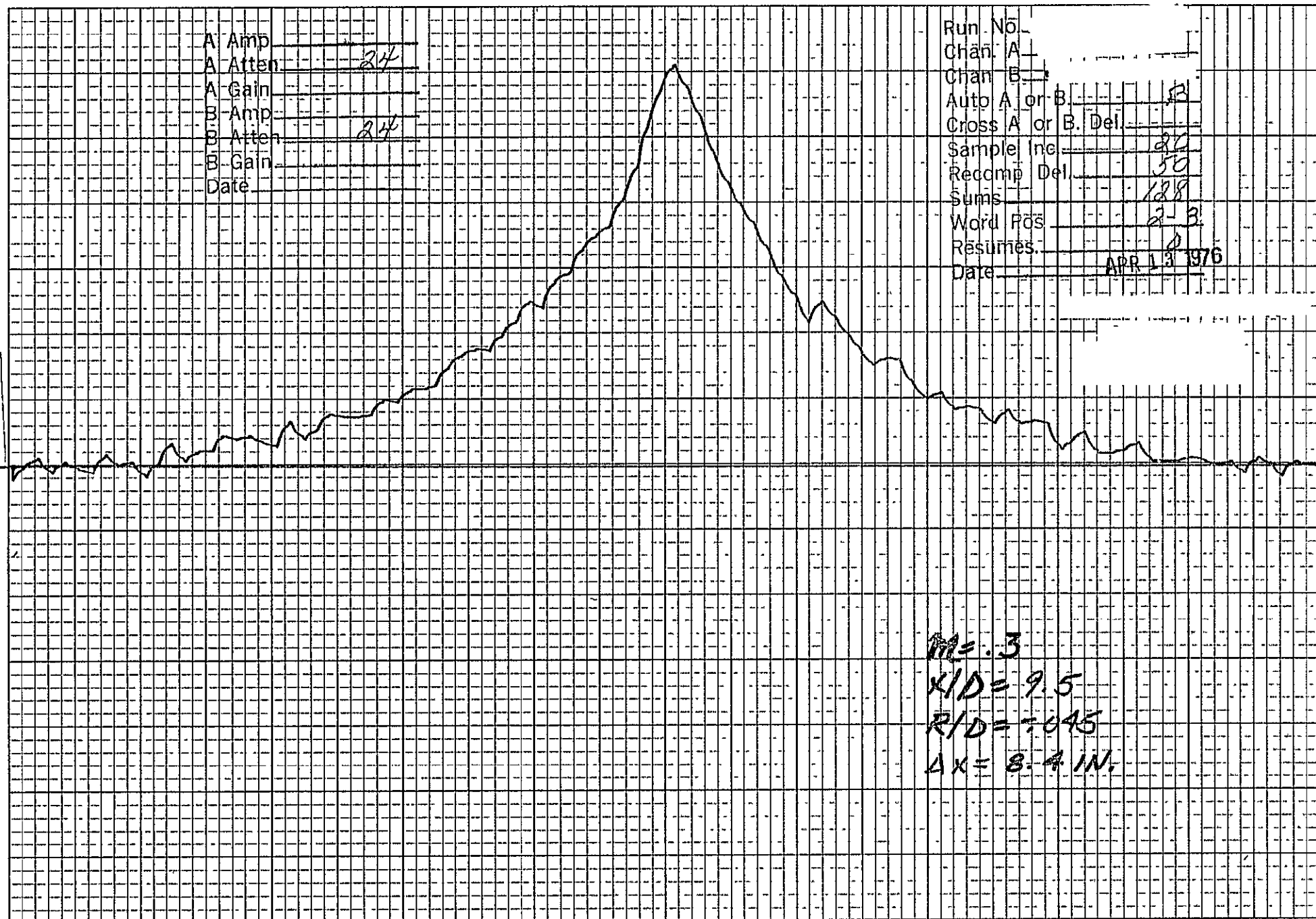


ME. 3
 X/D = 9.5
 R/D = -045
 ΔX = 4.4 IN.

A Amp _____
A Atten 24
A Gain _____
B Amp _____
B Atten 24
B Gain _____
Date _____

Run No _____
Chan A _____
Chan B _____
Auto A or B B
Cross A or B Del _____
Sample Inc 20
Recamp Del 50
Sums 128
Word Pos 2-3
Resumes 0
Date APR 13 1976

D-132



$M = .3$
 $X/D = 9.5$
 $R/D = 7.045$
 $\Delta X = 8.4 \text{ IN.}$

A Amp
 A Atten 24
 A Gain
 B Amp
 B Atten 24
 B Gain
 Date

Run No.
 Chan. A
 Chan. B
 Auto A. or B.
 Cross A or B Del. A
 Sample Inc. 100
 Recomp Del. 2
 Sums 128
 Word Pos. 2-4
 Resumes. 2
 Date APR 13 1975

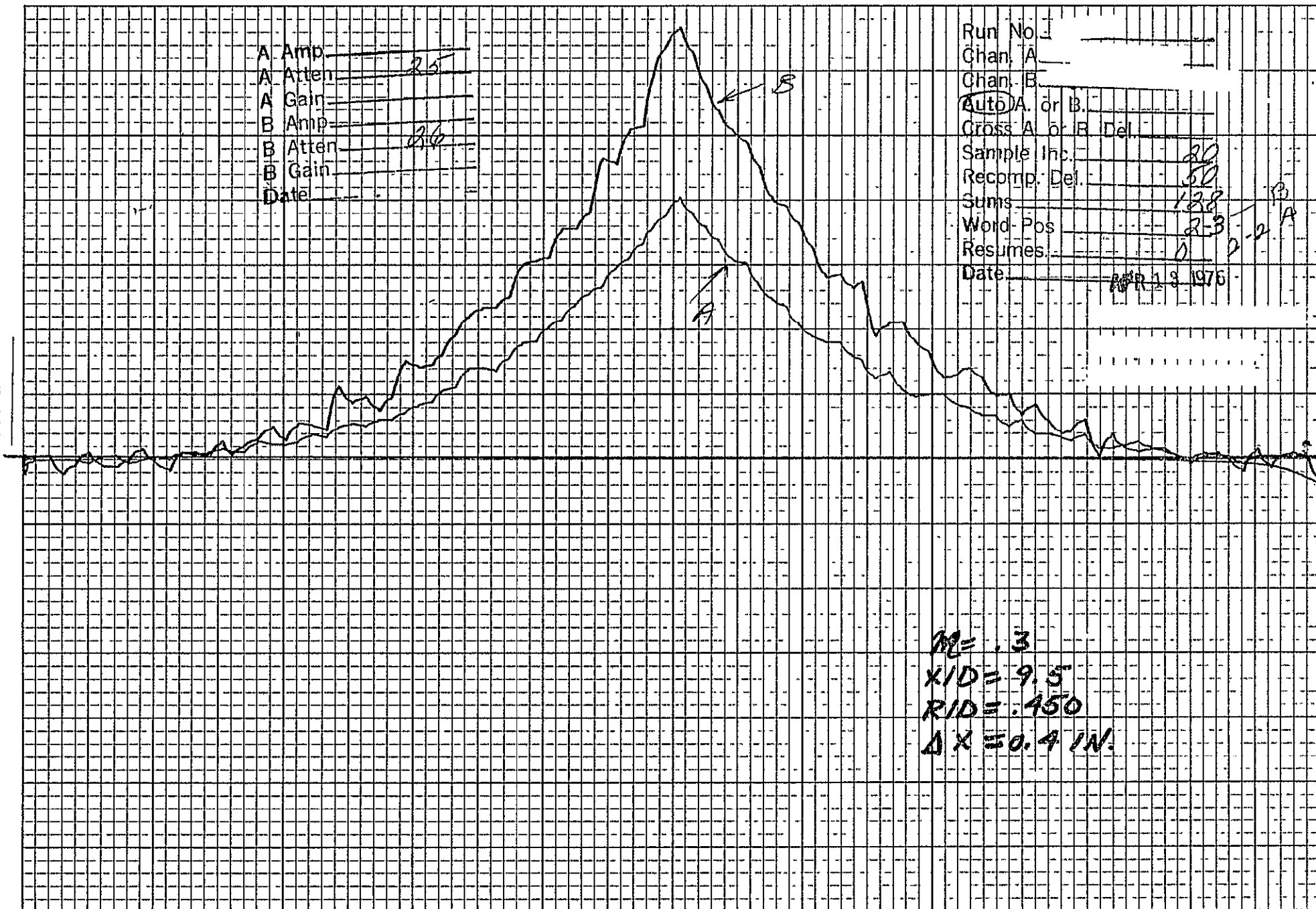


D-133

ORIGINAL PAGE IS
 OF POOR QUALITY

A Amp _____
A Atten 2.5
A Gain _____
B Amp _____
B Atten 2.6
B Gain _____
Date _____

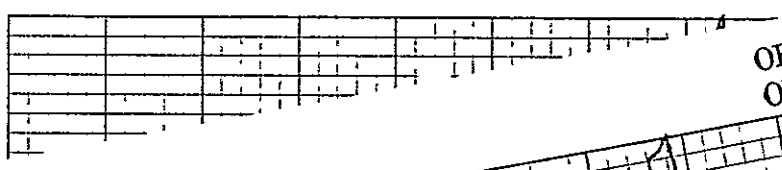
Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. _____
Sample Inc. 20
Recomp. Del. 50
Sums 128
Word Pos 2-3
Resumes 0
Date APR 13 1976



$ME = .3$
 $X/D = 9.5$
 $R/D = .450$
 $\Delta X = 0.4 IN.$

No. XY-1001-SP 1

RECORDING CHARTS
 GRAPHIC CONTROLS CORPORATION
 BUFFALO, NEW YORK
 PRINTED IN U.S.A.



ORIGINAL PAGE IS
 OF POOR QUALITY

Run No. 1
 Chan. A 1
 Chan. B 1
 Auto A or B 1
 Cross A or B Del. 50
 Sample Inc. 50
 Recomp. Del. 128
 Sums 0
 Word Pos. 0
 Resumes APR 13 1976
 Date

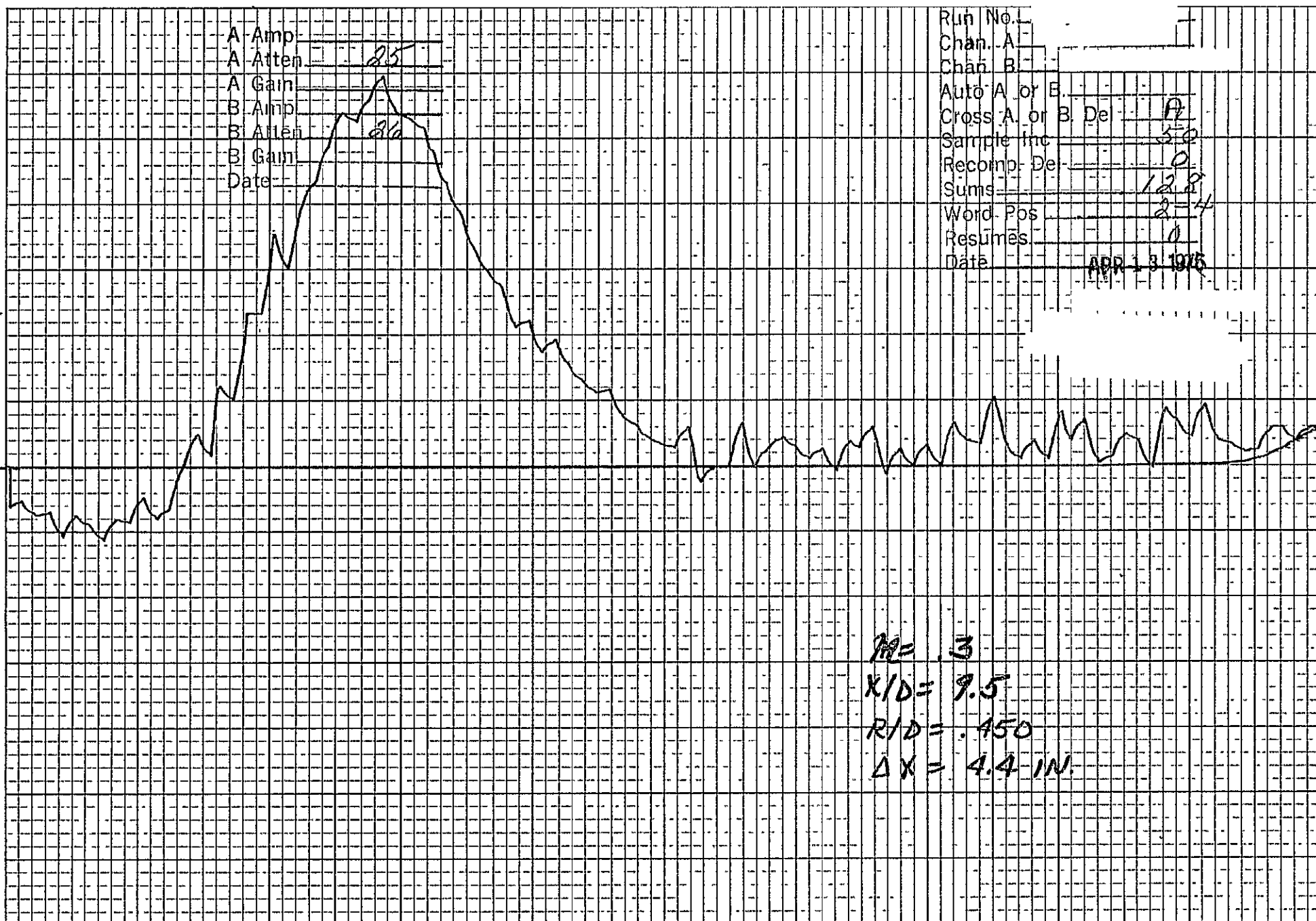
A Amp. 25
 A Atten. 20
 A Gain 20
 B Amp. 20
 B Atten. 20
 B Gain 20
 Date

$M = 3$
 $X/D = 9.5$
 $R/D = .950$
 $\Delta x = 0.9 \text{ in.}$



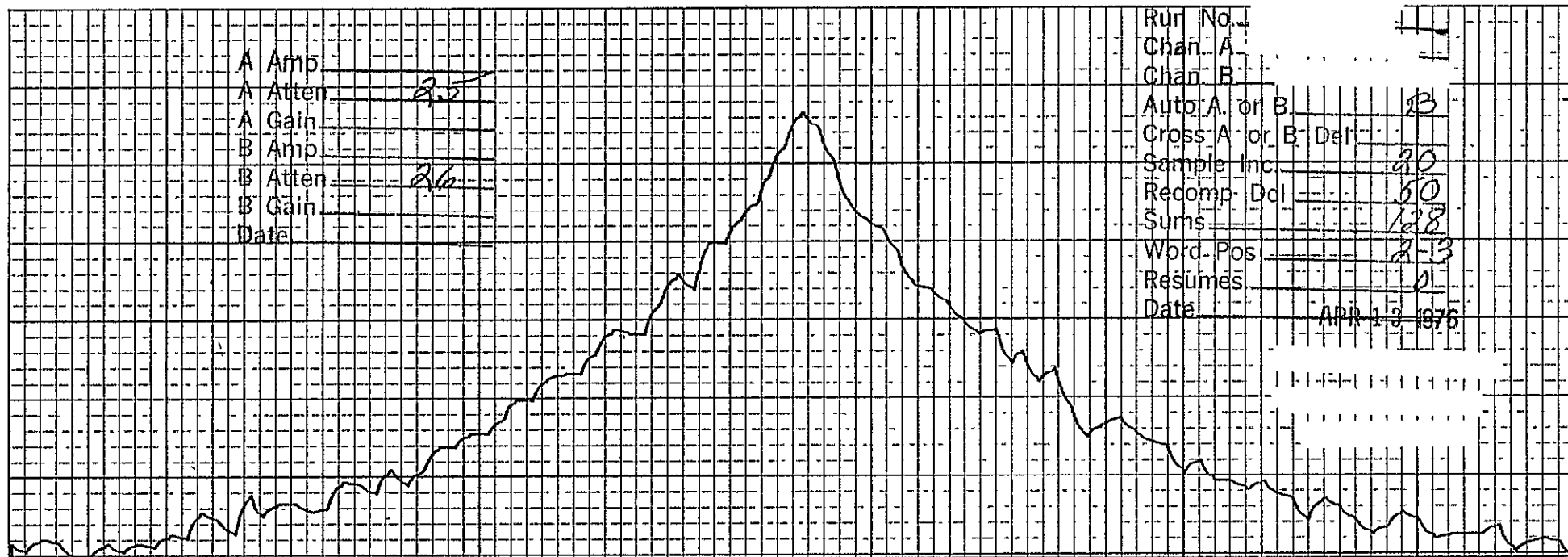
A Amp
A Atten 25
A Gain
B Amp
B Atten 26
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A or B
Cross A or B. De A
Sample Inc 5.0
Recomp. De 0
Sums 12.8
Word Pos 2-4
Resumes 0
Date APR 13 1975



A Amp _____
 A Atten 2.5
 A Gain _____
 B Amp _____
 B Atten 2.6
 B Gain _____
 Date _____

Run No. _____
 Chan. A _____
 Chan. B _____
 Auto A. or B. B
 Cross A. or B. Del _____
 Sample Inc. 20
 Recomp. Del 50
 Sums 128
 Word Pos 2-3
 Resumes 0
 Date APR 13 1976



Me. 3
 $\lambda/D = 9.5$
 $R/D = .450$
 $\Delta x = 8.4 \text{ IN.}$

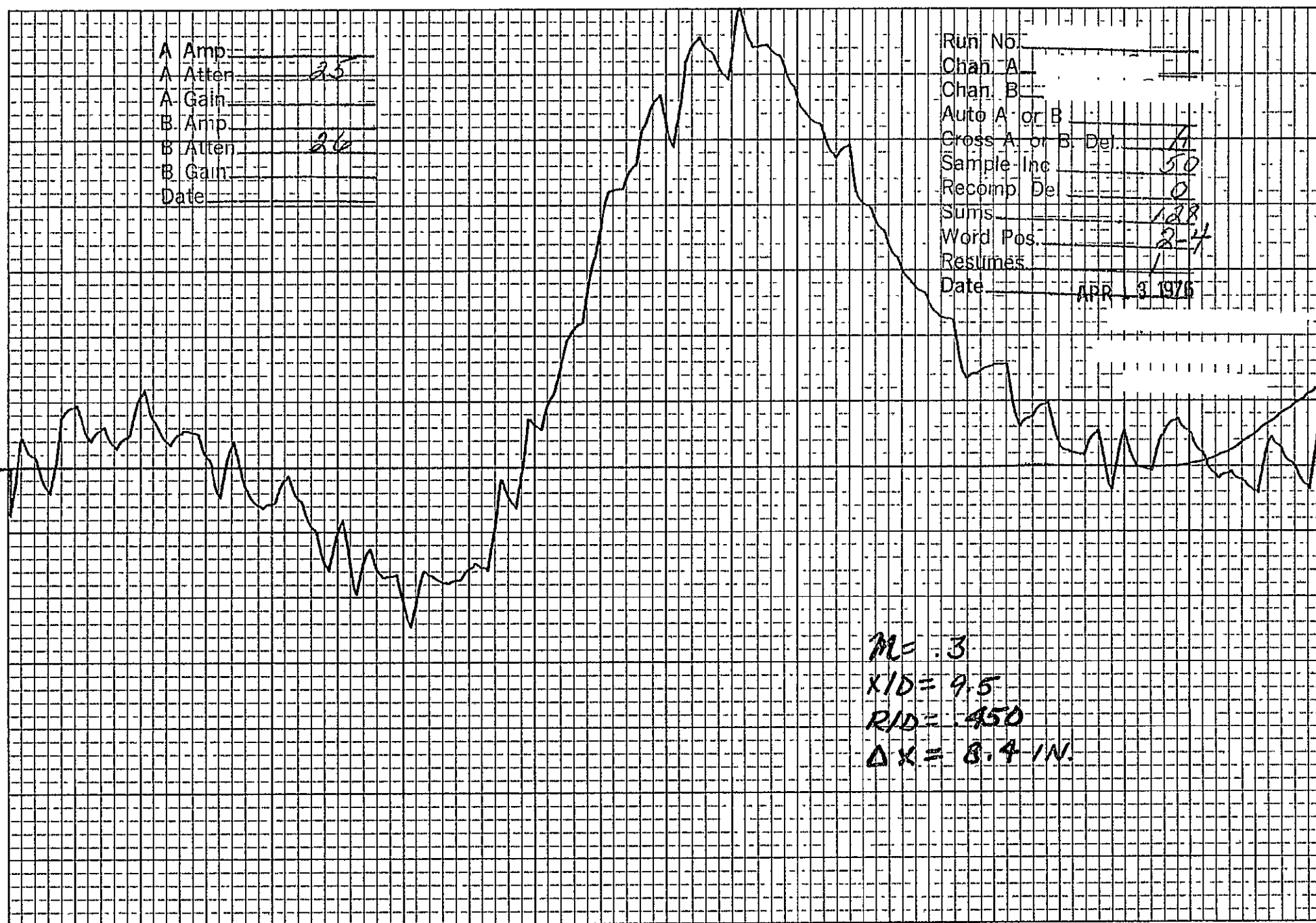
D-138

ORIGINAL PAGE IS
 OF POOR QUALITY

A Amp _____
A Atten 25
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del. 1
Sample Inc. 50
Recomp Del. 0
Sums 128
Word Pos. 2-4
Resumes 1
Date APR 3 1976

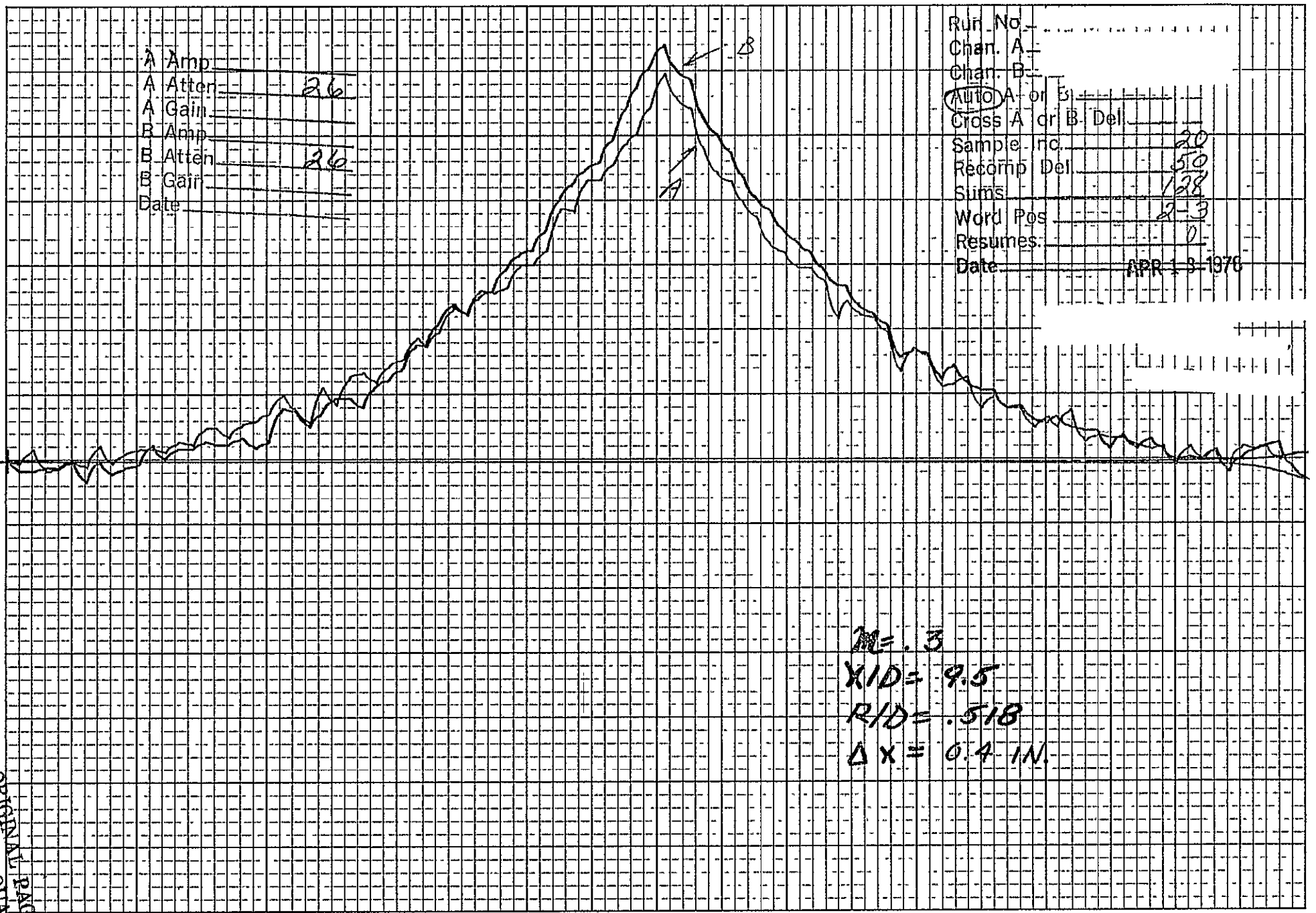
D-139



$M = .3$
 $X/D = 9.5$
 $R/D = .450$
 $\Delta X = 8.4 \text{ IN.}$

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

Run No _____
Chan. A _____
Chan. B _____
AUTO A or B _____
Cross A or B Del _____
Sample No 20
Recorp Del 50
Sums 128
Word Pos 2-3
Resumes 0
Date APR 13 1970



$M = .3$
 $X/D = 9.5$
 $R/D = .518$
 $\Delta X = 0.4 \text{ IN.}$

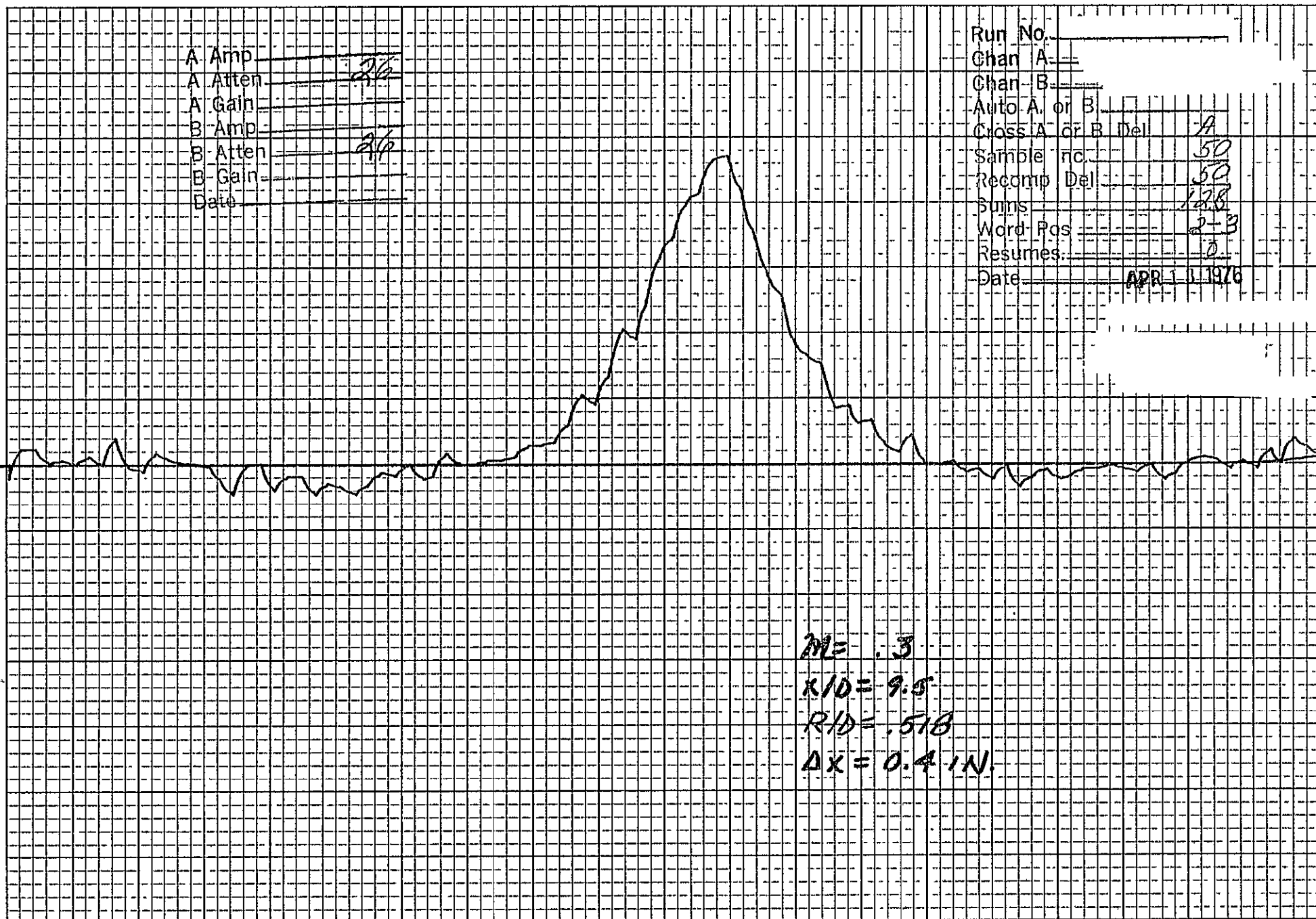
D-140

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten. 26
A Gain _____
B Amp _____
B Atten. 26
B Gain _____
Date _____

Run No. _____
Chan A _____
Chan B _____
Auto A. or B. _____
Cross A. or B. Del A
Sample no. 50
Recomp Del 50
Summs 128
Word Pos 2-3
Resumes 0
Date APR 10 1976

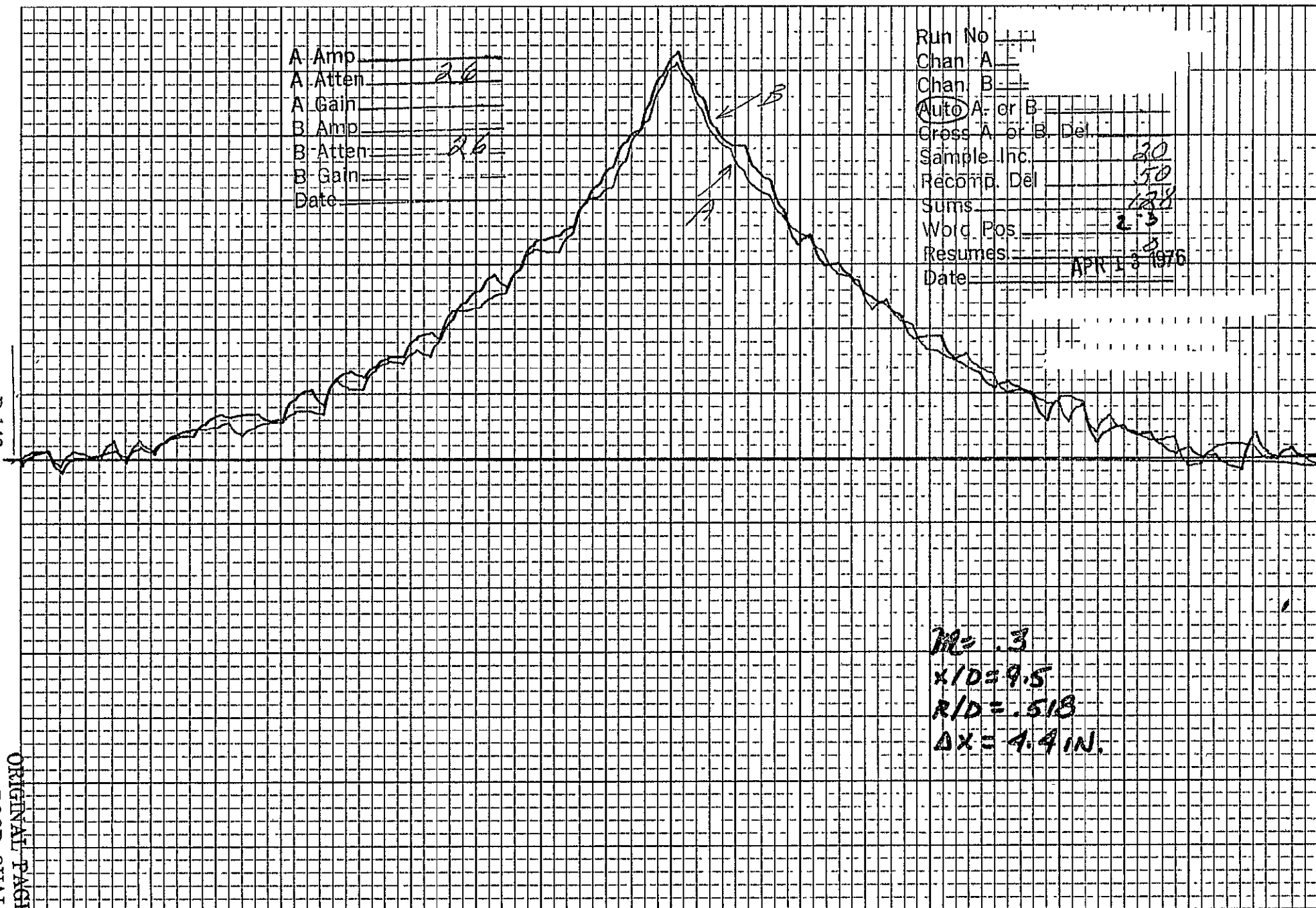
D-141



$M = .3$
 $K/D = 9.5$
 $R/D = .518$
 $\Delta x = 0.4 \text{ IN.}$

A Amp _____
A Atten. 2.6
A Gain _____
B Amp _____
B Atten. 2.6
B Gain _____
Date _____

Run No. 111
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. _____
Sample Inc. 30
Recorp. Del. 50
Sums 128
Word Pos. 2.3
Resumes 8
Date APR 13 1976



$M = .3$
 $X/D = 9.5$
 $R/D = .518$
 $\Delta X = 4.4 \text{ IN.}$

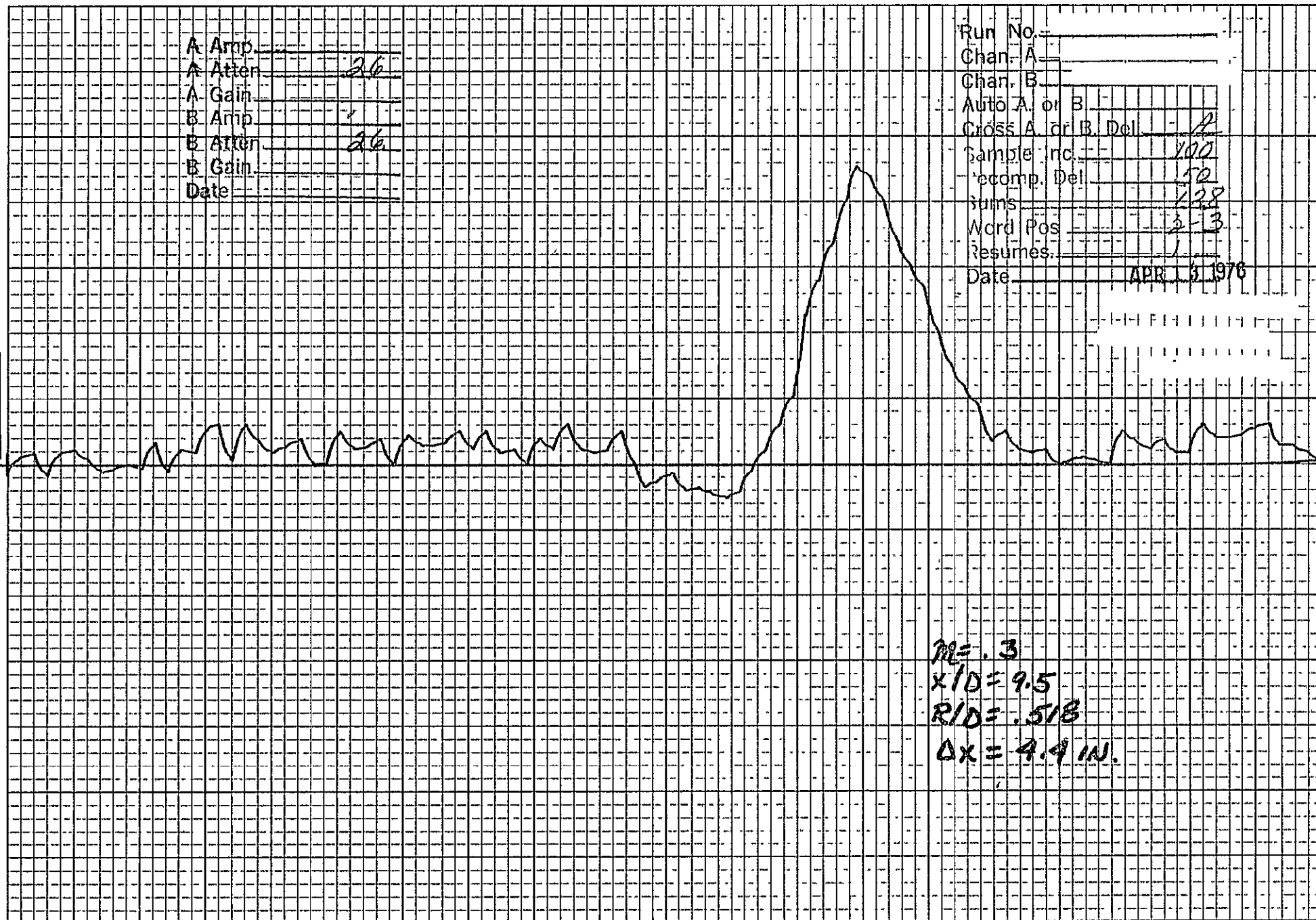
D-142

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp. _____
A Atten. 26
A Gain. _____
B Amp. _____
B Atten. 26
B Gain. _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. 2
Sample Inc. 100
Decomp. Del. 12
Runs 128
Word Pos. 2-3
Resumes. 1
Date APR 13 1976

D-143



$ME = .3$
 $X/D = 9.5$
 $R/D = .518$
 $\Delta x = 4.9 \text{ IN.}$

A Amp _____
A Atten. 26
A Gain _____
B Amp _____
B Atten. 26
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del. _____
Sample Inc. 20
Recomp. Del. 50
Sums 128
Word Pos. 2-3
Resumes 0
Date APR 13 1976

D-144

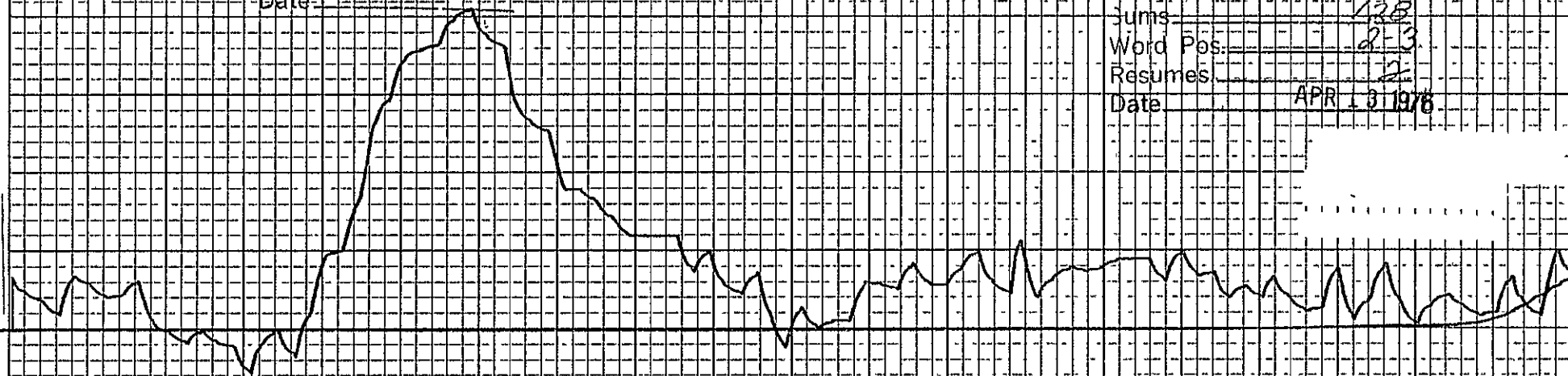
$M = 3$
 $X/D = 9.5$
 $R/D = .518$
 $\Delta X = 8.4 \text{ IN.}$

ORIGINAL PAGE IS
OF POOR QUALITY.

A Amp _____
A Atten 26
A Gain _____
B Amp _____
B Atten 26
B Gain _____
Date _____

Run No. _____
Chan. A. _____
Chan. B. _____
Auto. A. or B. _____
Cross A. or B. Del. A
Sample Inc. 100
Recomp. Del. 0
Sums 128
Word Pos. 2-3
Resumes 2
Date APR 13 1976

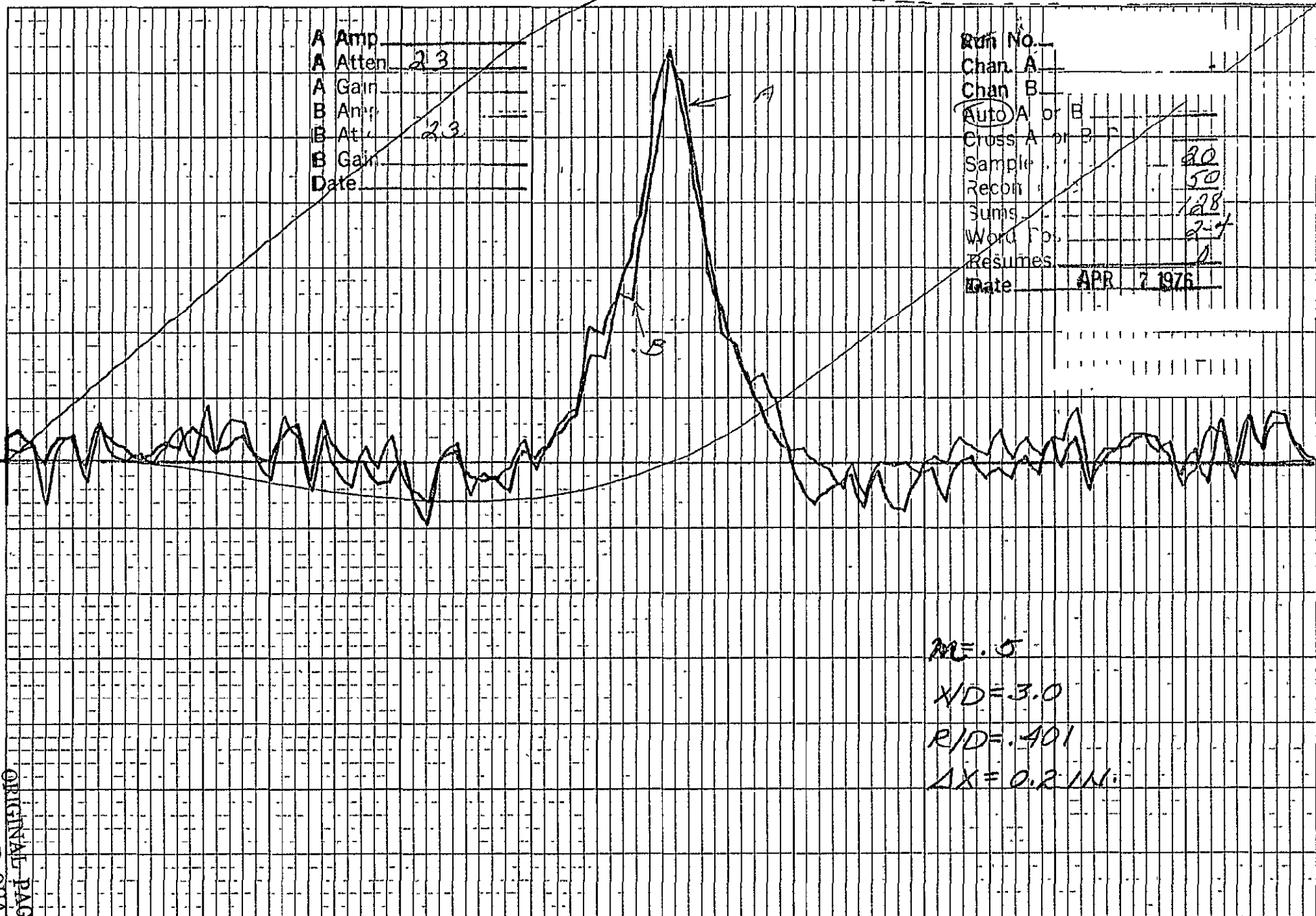
D-145



$M = .3$
 $x/D = 9.5$
 $R/D = .518$
 $\Delta x = 8.4 \text{ IN.}$

A Amp _____
A Atten 2.3
A Gain _____
B Amp _____
B Atten 2.3
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B _____
Sample _____ 20
Recon _____ 50
Sums _____ 128
Word Fb. _____ 2-4
Resumes _____ 0
Date APR 7 1976



$M = .5$
 $X/D = 3.0$
 $R/D = .401$
 $\Delta X = 0.2 \text{ IN.}$

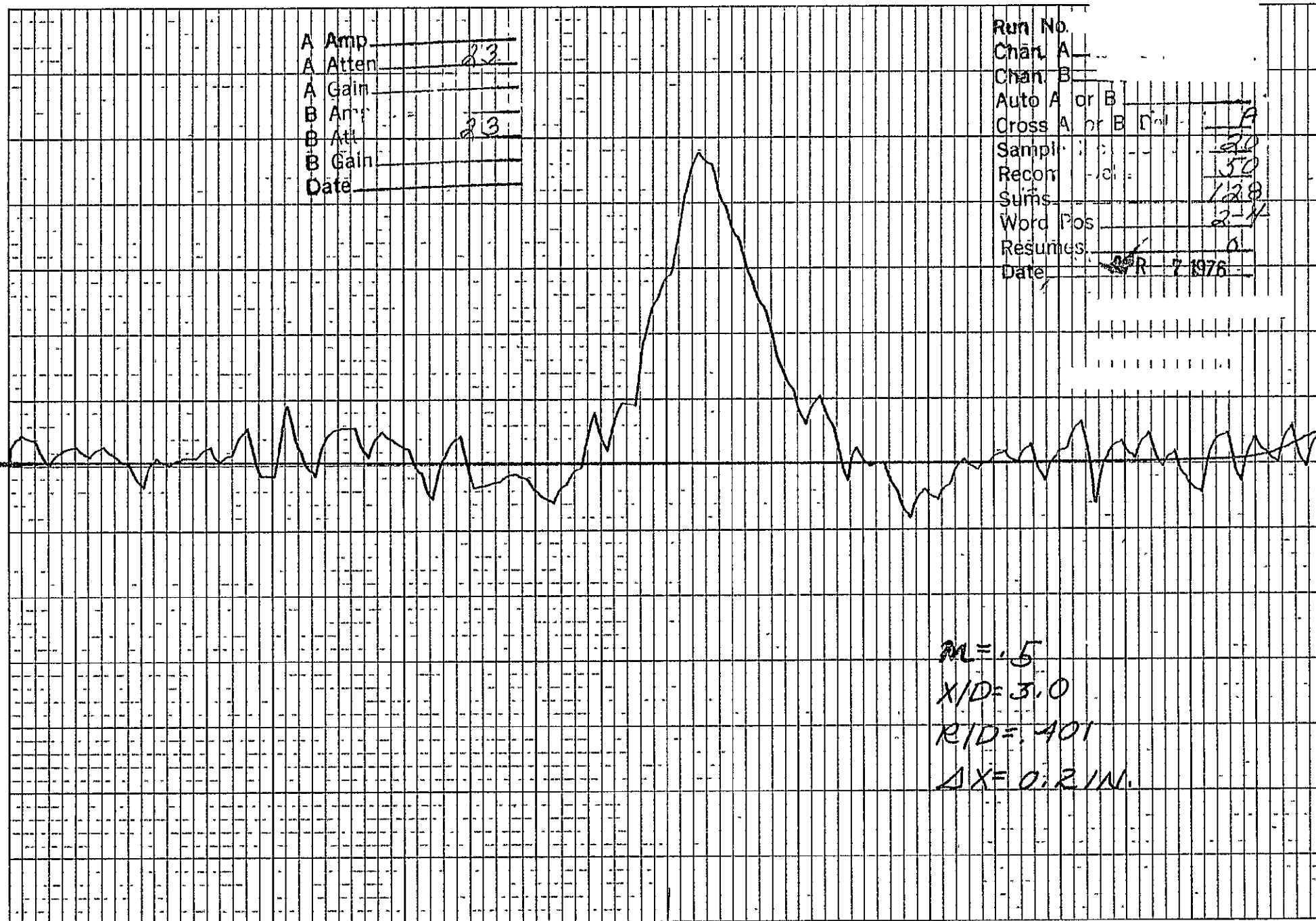
D-146

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No. _____
Chan A _____
Chan B _____
Auto A or B _____
Cross A or B A
Sample _____
Recon _____
Sum _____
Word Pos 2-14
Resumes 0
Date 25 R 7 1976

D-147



$M = 1.5$
 $X/D = 3.0$
 $R/D = 401$
 $\Delta X = 0.2 \text{ IN.}$

GRAPHIC CONTROLS CORPORATION
BUFFALO, N.Y. 14203
PRINTED IN U.S.A.

NO XY-1001 - SP 1

RECORDING CHARTS
GRAPHIC CONTROLS CORPORATION
BUFFALO, N.Y. 14203
PRINTED IN U.S.A.

A Amp 23
A Atten 23
A Gain 23
B Amp 23
B Att 23
B Gain 23
Date APR 7 1976

Run No. 20

Chan. A 50

Chan. B 128

Auto A or B 2-4-3

Cross A or B Del 8

Sample 2-4-3

Recom 8

Sums 2-4-3

Word Pos 8

Resumes 8

Date APR 7 1976

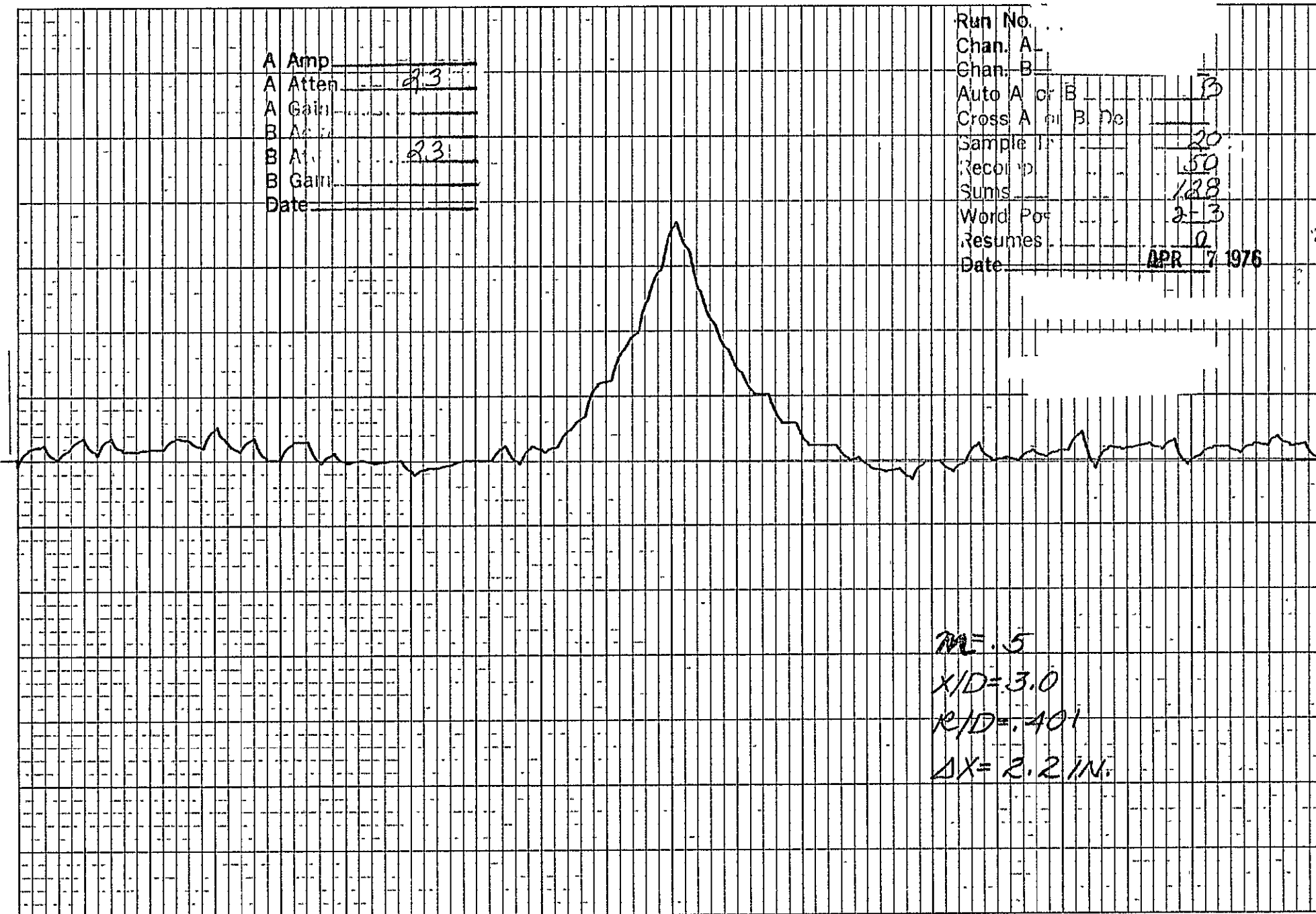
$M = 1.5$
 $X/D = 3.0$
 $R/D = .401$
 $\Delta X = 1.2 IN.$

D-148

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten. 2.3
A Gain _____
B Atten. _____
B Gain _____
Date _____

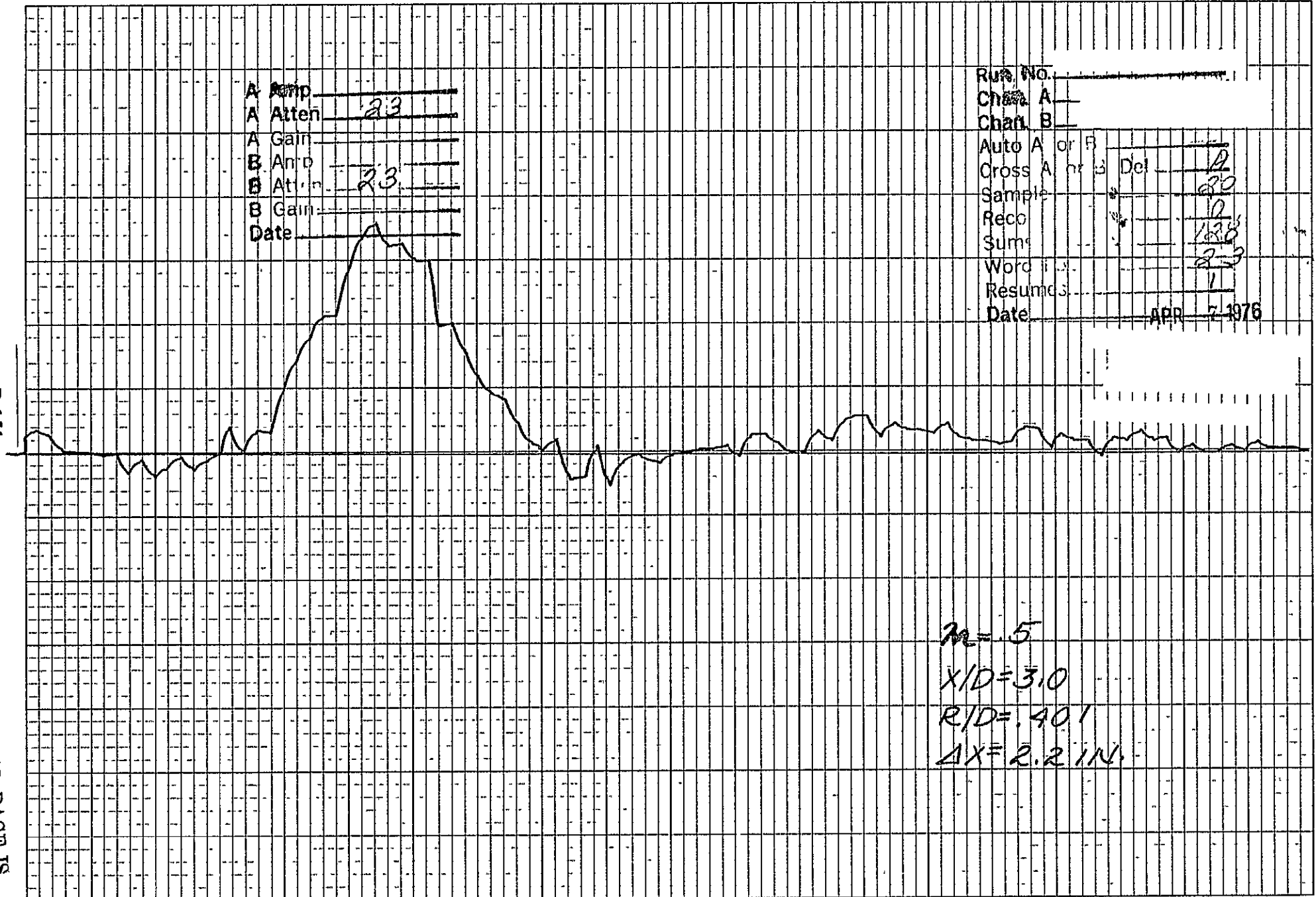
Run No. _____
Chan. A _____
Chan. B _____
Auto A or B B
Cross A or B No _____
Sample Int. 20
Recol. Int. 50
Sums 128
Word Pos. 2-3
Resumes 0
Date APR 7 1976



$M = .5$
 $X/D = 3.0$
 $R/D = .401$
 $\Delta X = 2.2 \text{ IN.}$

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No. _____
Chan A _____
Chan B _____
Auto A or B _____
Cross A or B Del 2
Sample 20
Reco 10
Sum 128
Word 23
Resumes 1
Date APR 7 1976

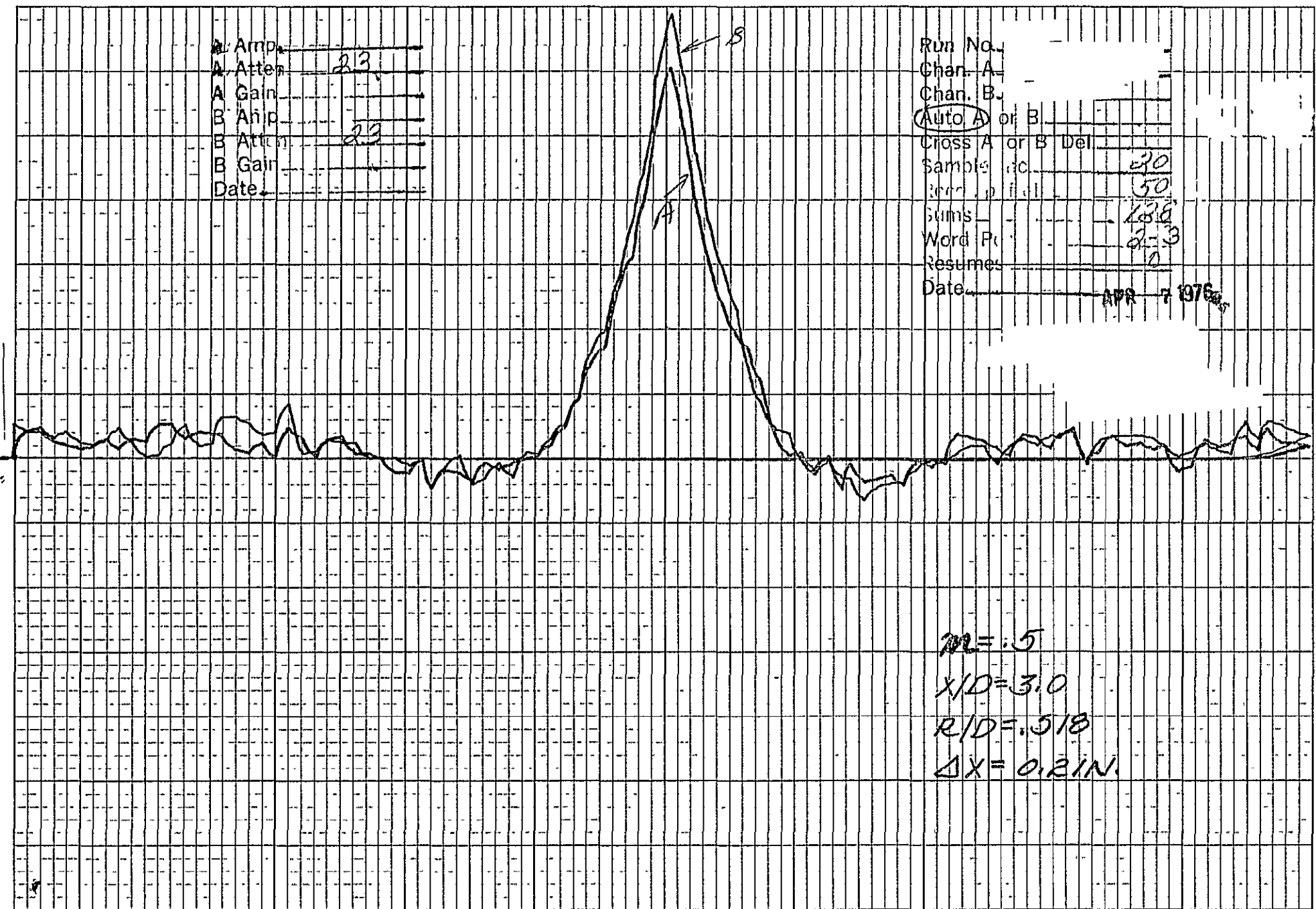


$m = .5$
 $X/D = 3.0$
 $R/D = .401$
 $\Delta X = 2.2 \text{ IN.}$

A Amp. _____
A Atten. 23
A Gain _____
B Amp. _____
B Atten. 23
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del. _____
Sample inc. 20
Term. p. full 50
Stims _____ 136
Word Pt. _____ 2-3
Resumes _____ 0
Date _____ APR 7 1976

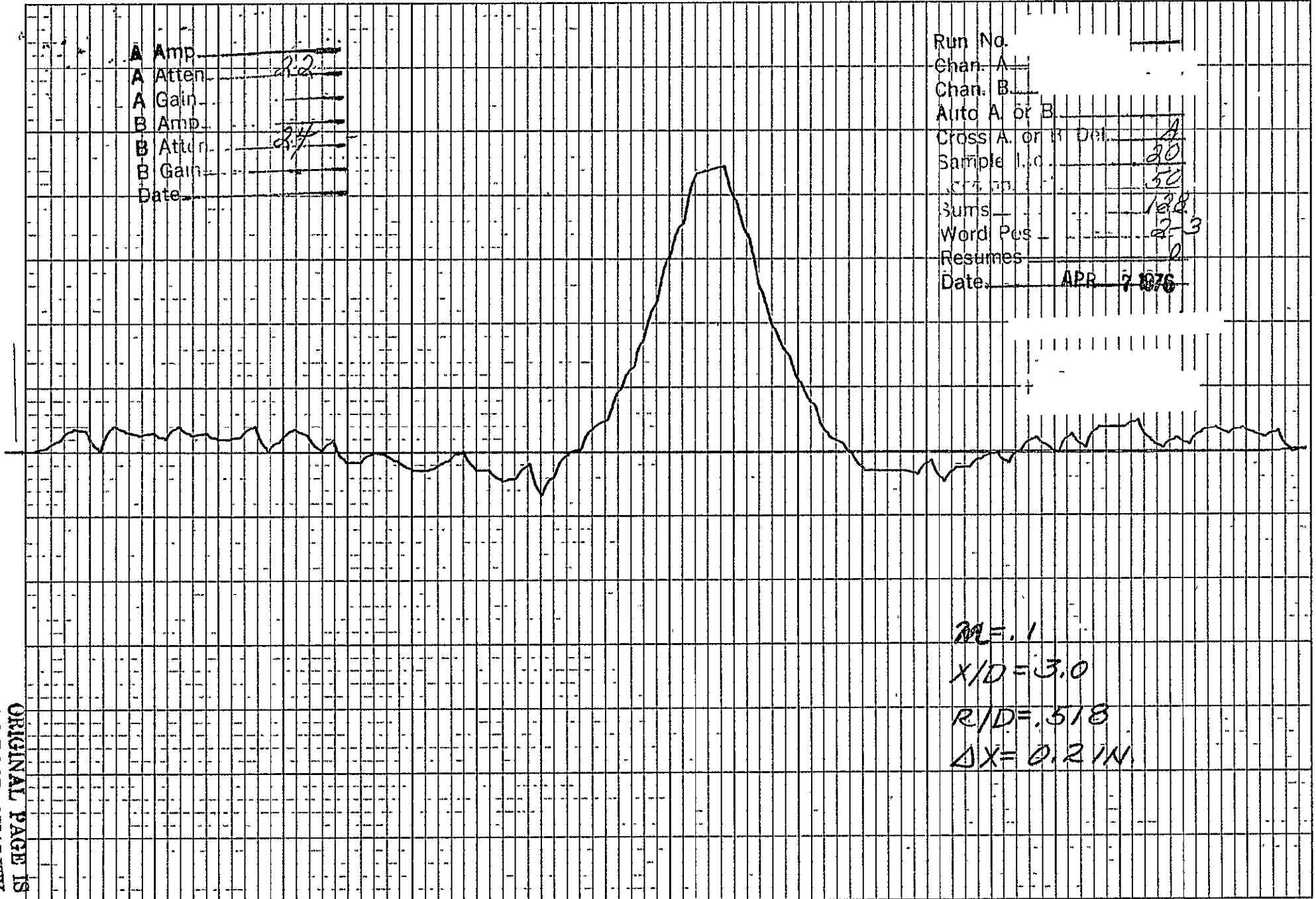
D-152



$m = 1.5$
 $X/D = 3.0$
 $R/D = .518$
 $\Delta X = 0.2 \text{ IN.}$

A Amp. _____
A Atten. 2.2
A Gain. _____
B Amp. _____
B Atten. 2.4
B Gain. _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A. or B. Del. A
Sample I.C. 20
C.C. 50
Sums 138
Word Pos 2-3
Resumes 0
Date APR 7 1976



$M = 1$
 $X/D = 3.0$
 $R/D = .518$
 $\Delta X = 0.2 \text{ IN.}$

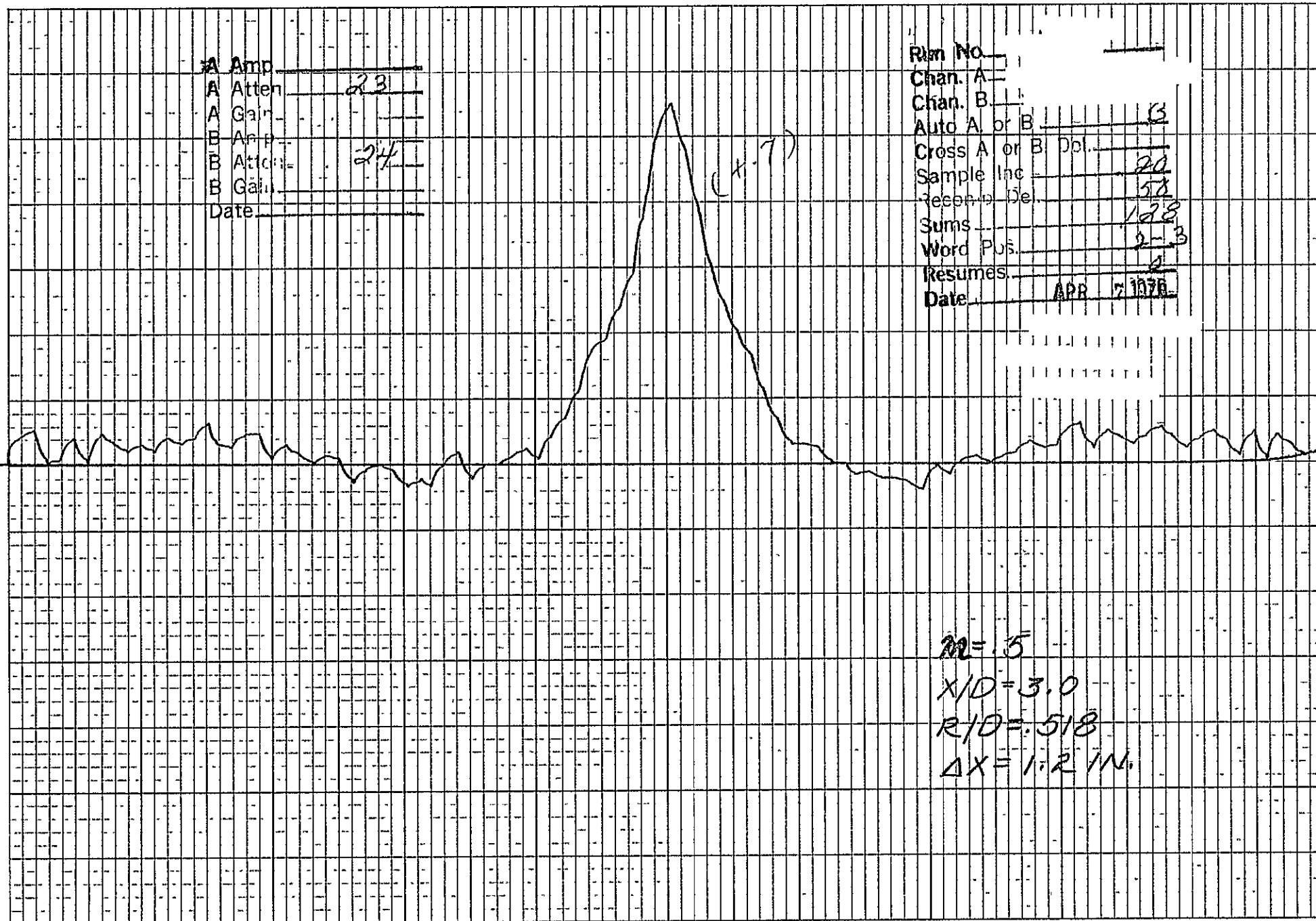
D-153

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 24
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B 3
Cross A or B Dpt. _____
Sample Inc 20
Record Del. 52
Sums 128
Word Pos. 2-3
Resumes 2
Date APR 7 1976

D-154

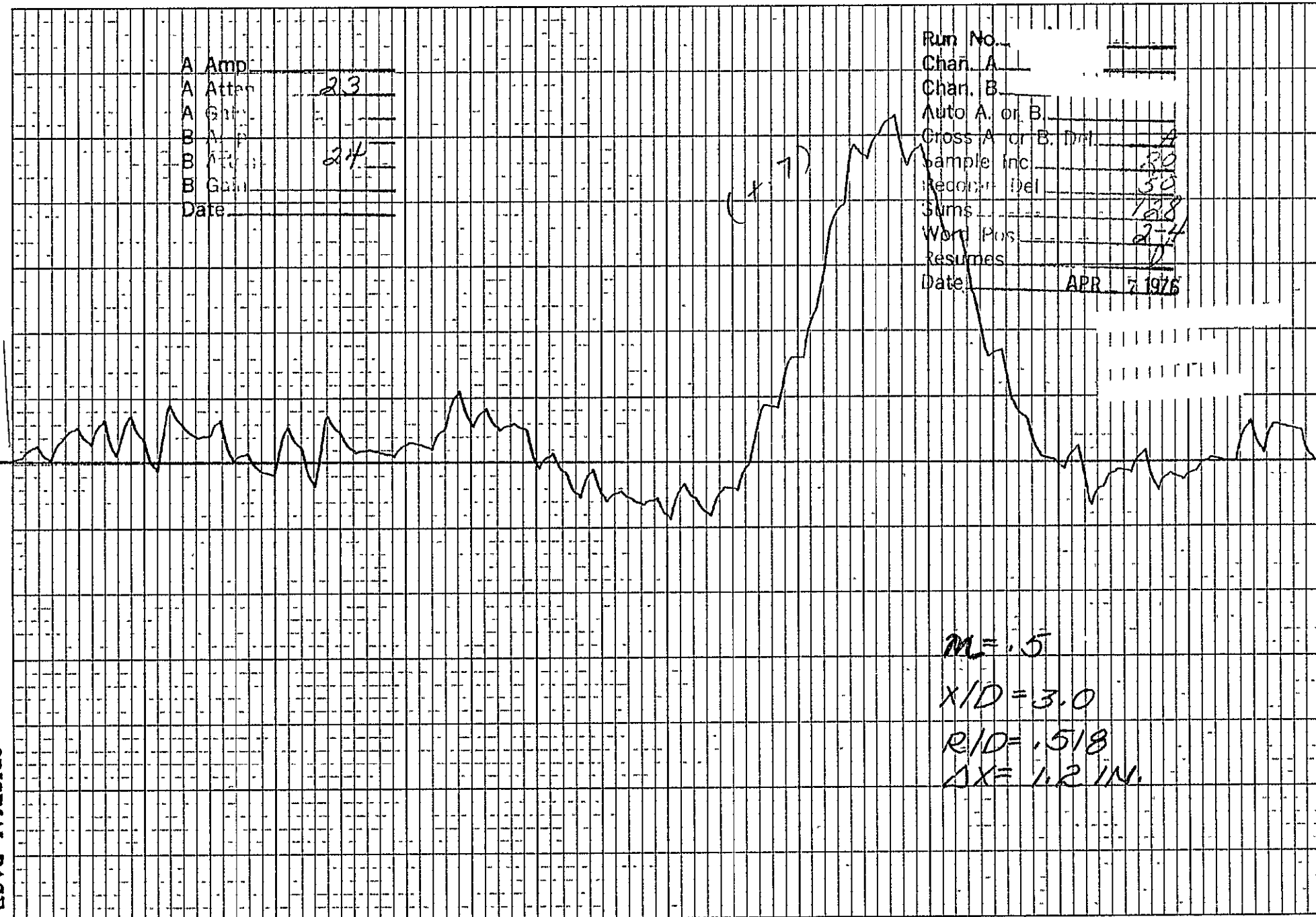


$M = .5$
 $X/D = 3.0$
 $R/D = .518$
 $\Delta X = 1.2 \text{ IN.}$

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 24
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A or B. Int. 2
Sample Inc. 30
Record Int. 50
Sums 128
Word Pos. 2-4
Resumes 0
Date APR 7 1976

D-155

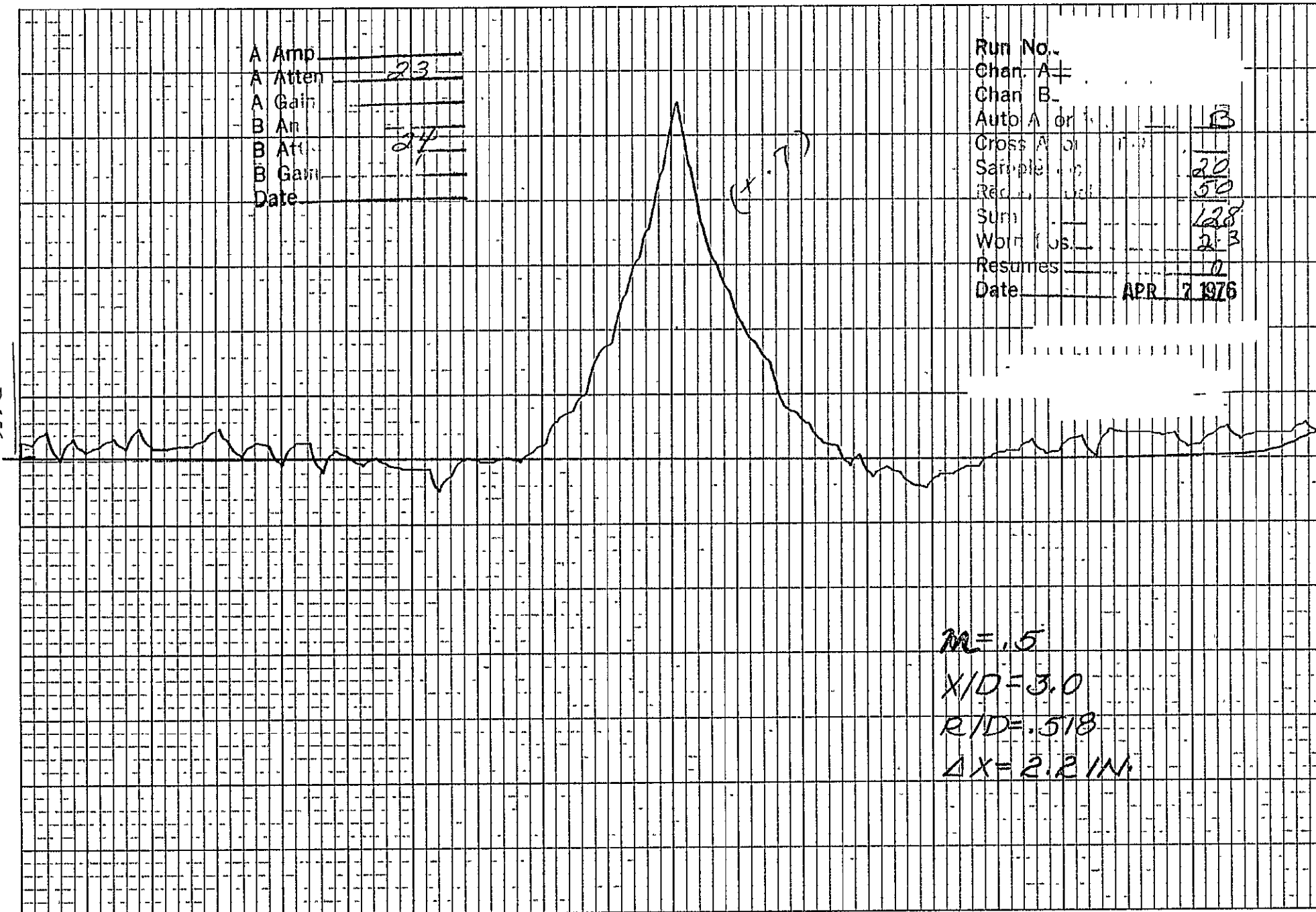


$M = .5$
 $X/D = 3.0$
 $R/D = .518$
 $\Delta X = 1.2 \text{ IN.}$

A Amp _____
A Atten 23
A Gain _____
B Am _____
B Att 24
B Gain _____
Date _____

Run No. _____
Chan. A +
Chan. B _____
Auto A or B B
Cross A or B _____
Sample _____
Rec. _____
Sum _____
Wor. (us) _____
Resumes _____
Date APR 7 1976

D-156

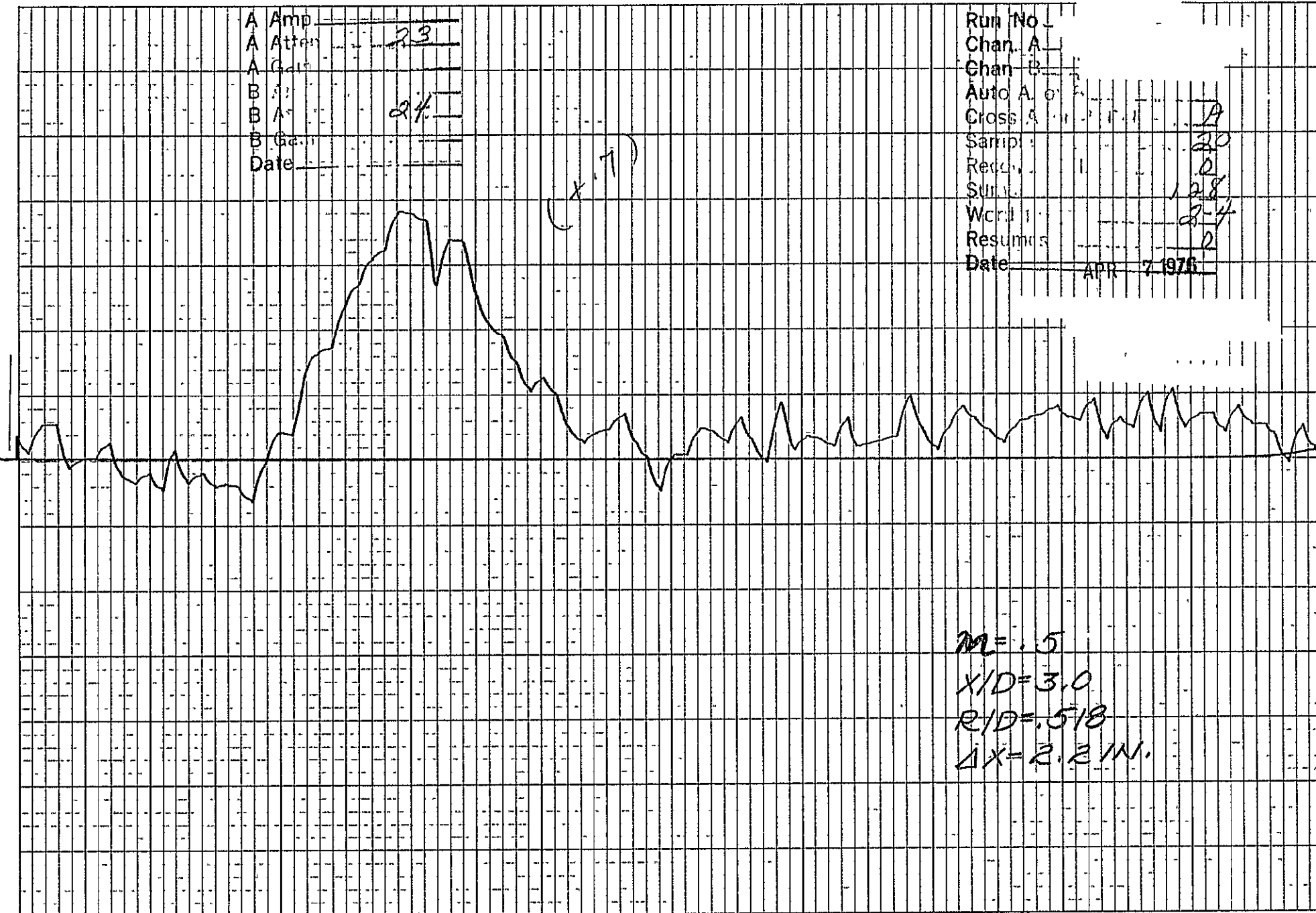


$M = 1.5$
 $X/D = 3.0$
 $R/D = .518$
 $\Delta X = 2.2 \text{ IN.}$

A Amp _____
A Atten 23
A Gain _____
B Atten _____
B Gain 24
Date _____

Run No _____
Chan. A _____
Chan. B _____
Auto A. 0 _____
Cross A. 0 _____
Samp. _____
Recd. _____
Sum. _____
Word _____
Resum. _____
Date APR 7 1976

D-157

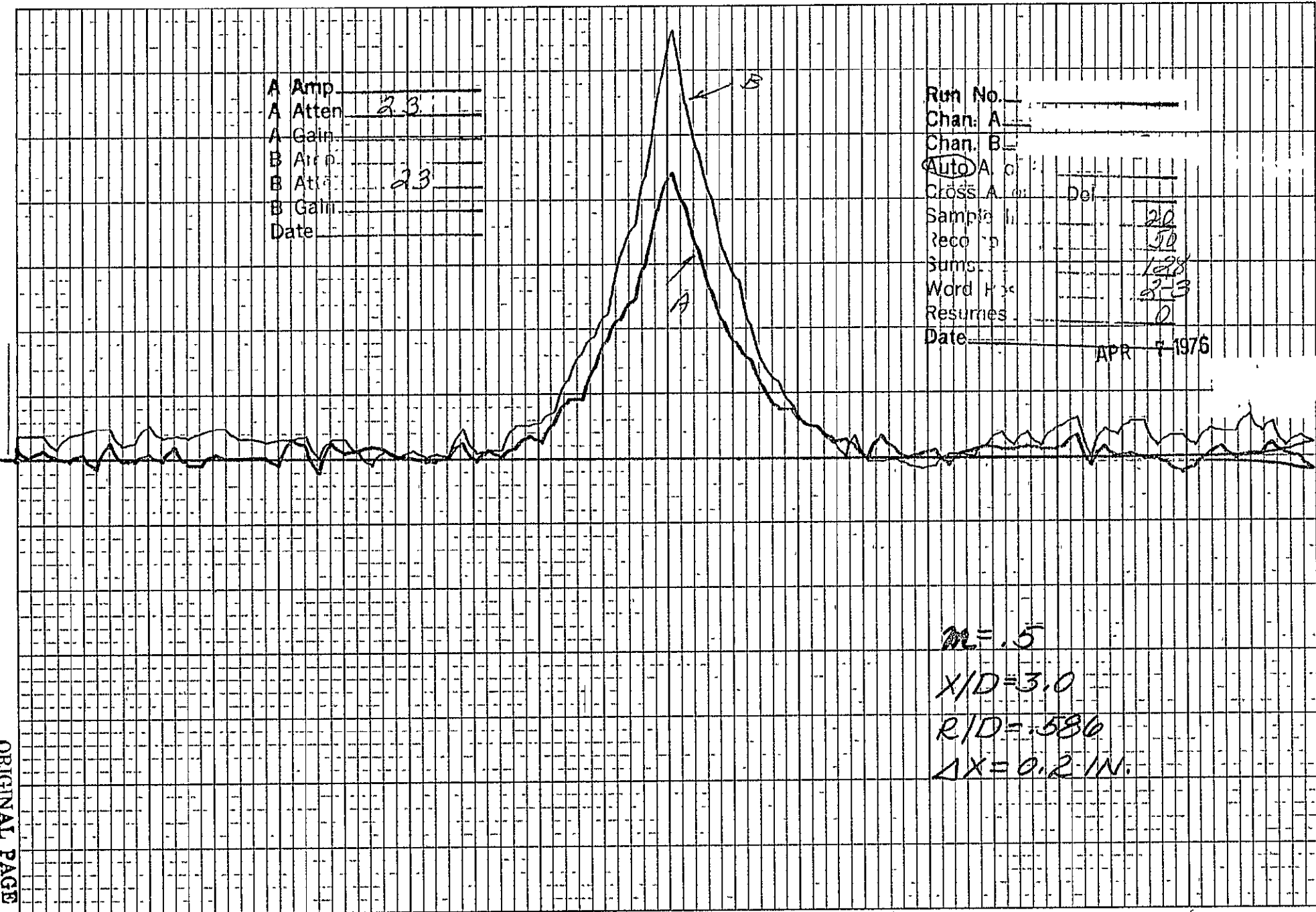


$M = .5$
 $X/D = 3.0$
 $R/D = .518$
 $\Delta X = 2.2 \text{ IN.}$

A Amp _____
A Atten 2.3
A Gain _____
B Amp _____
B Atten 2.3
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
(Auto) A. of _____
Cross A. of _____
Sample In _____
Reco p _____
Summ. _____
Word H. _____
Resumes _____
Date _____

APR 7 1975



$M = .5$
 $X/D = 3.0$
 $R/D = .586$
 $\Delta X = 0.2 \text{ IN.}$

D-158

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 2.8
A Gain _____
B Amp _____
B Atten 2.3
B Gain _____
Date _____

Run No. _____
Chan. A 1
Chan. B _____
Auto A. on ☐
Cross A. on ☐ Del. A
Sample _____
Recd _____
Sum _____
Word 2-4
Resume 01
Date APR 7 1976

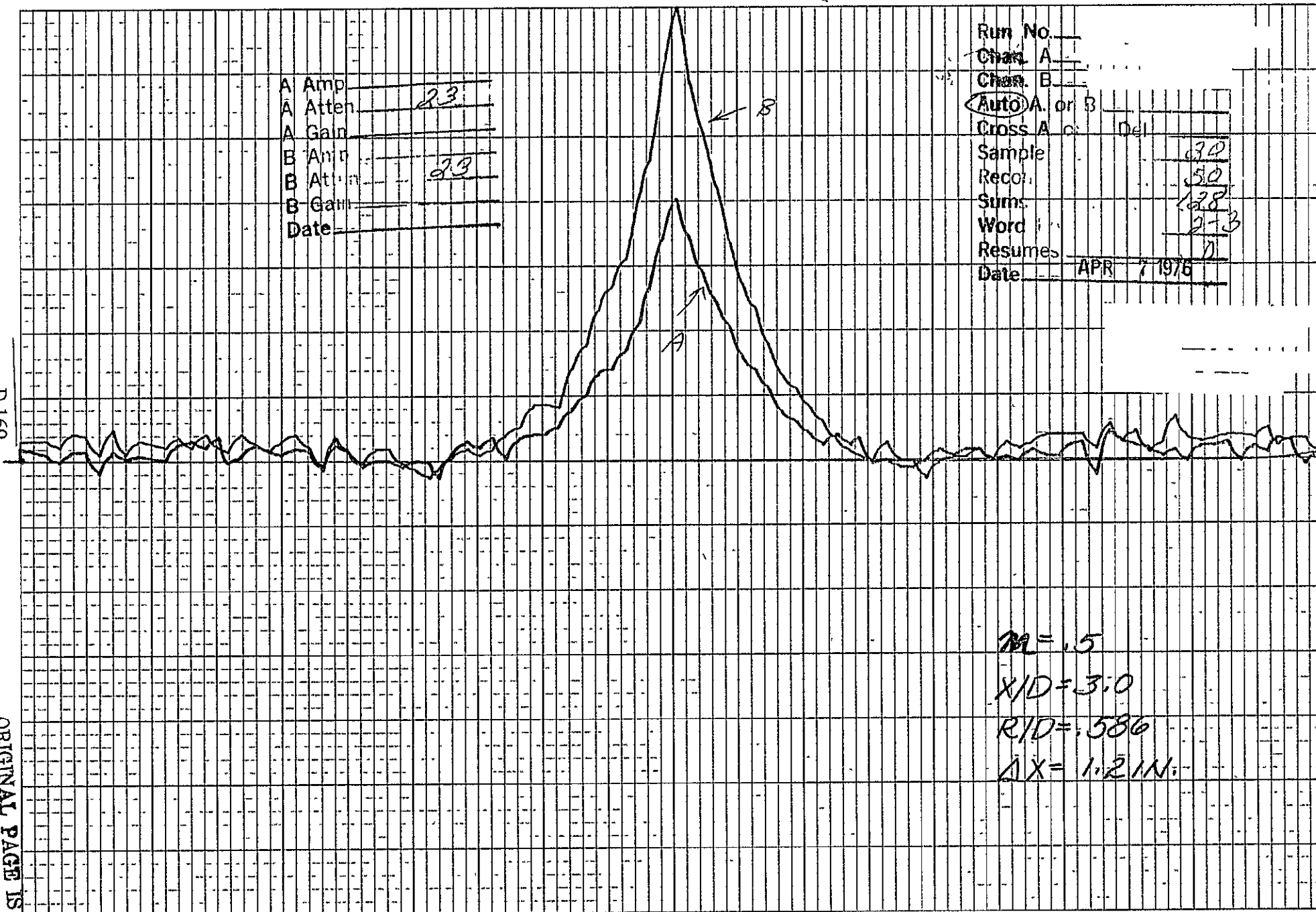
D-159

$M = .5$
 $X/D = 3.0$
 $R/D = .586$
 $\Delta X = 0.2 \text{ IN.}$

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No. _____
Chan A _____
Chan B _____
Auto A or B _____
Cross A or B _____
Sample _____
Recon _____
Sum _____
Word _____
Resumes _____
Date APR 7 1976

D-160

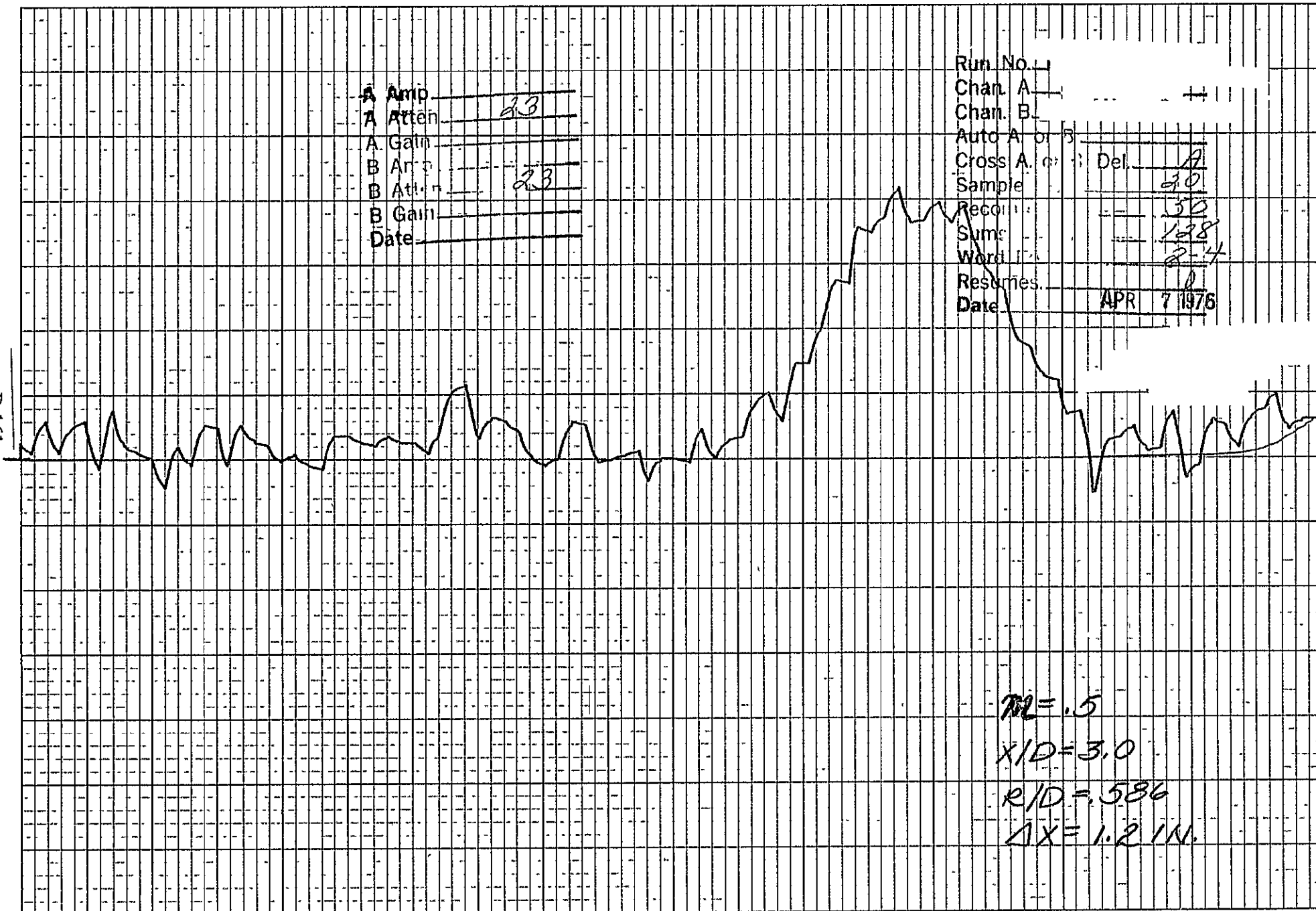


$M = 1.5$
 $X/D = 3.0$
 $R/D = .586$
 $\Delta X = 1.21 \text{ IN.}$

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del. A
Sample 20
Recor. 30
Sum 128
Word 2-4
Resumes. 0
Date APR 7 1976

D-161

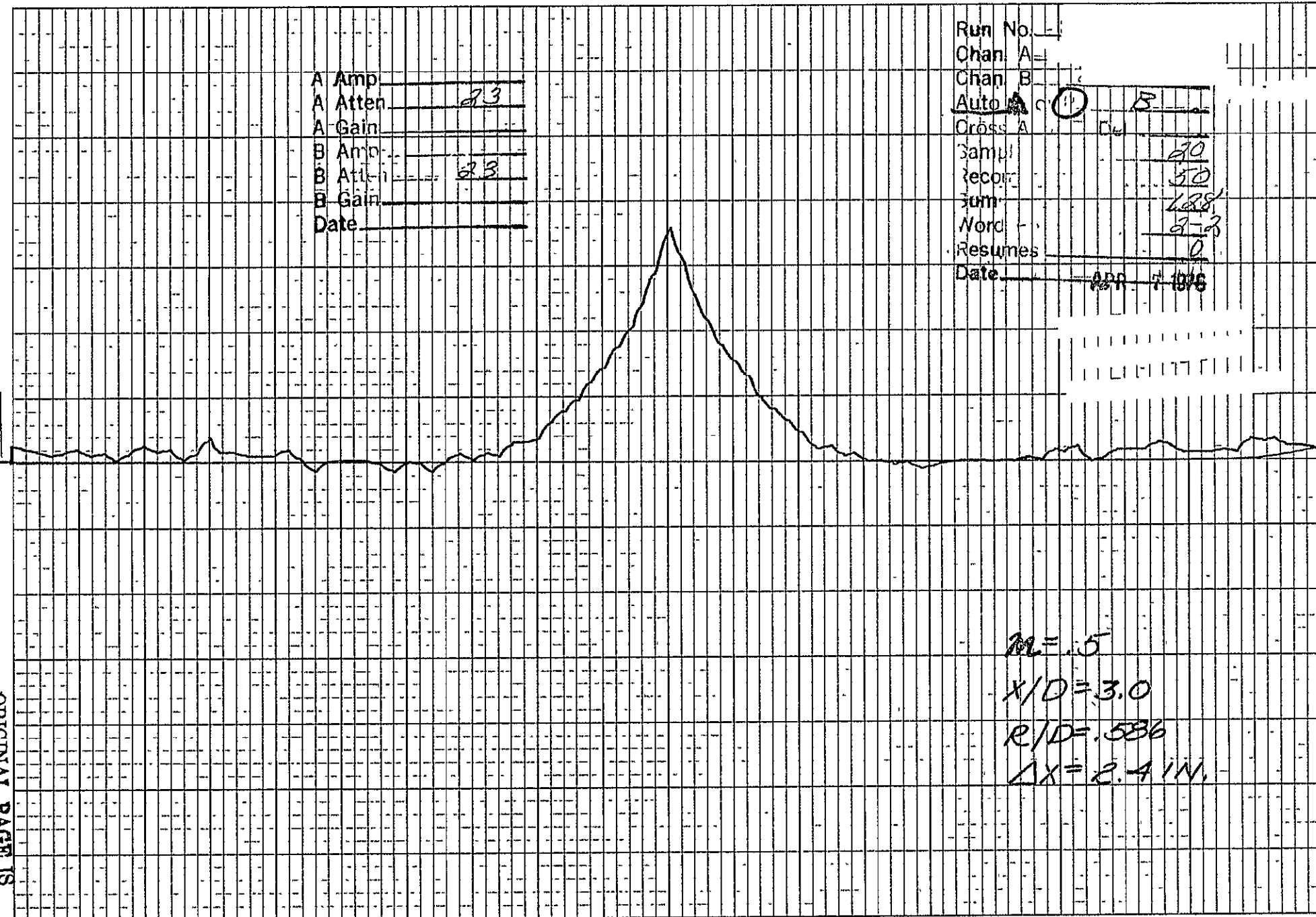


$M = 1.5$
 $X/D = 3.0$
 $R/D = 5.86$
 $\Delta X = 1.2 \text{ IN.}$

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto ☒ C ☐ B ☐ A
Cross A _____
Sample 20
Record 50
Sum 128
Word 2-3
Resumes 0
Date APR 7 1976

D-162



$M = .5$
 $X/D = 3.0$
 $R/D = .586$
 $\Delta X = 2.4 \text{ IN.}$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp
A Attenuation 23
A Gain
B Anti
B Attenuation 23
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A.C.P.
Gross A.C.P. Del A
Sample 20
Reco 1
Summ 128
Word 2-4
Resumes
Date APR 7 1976

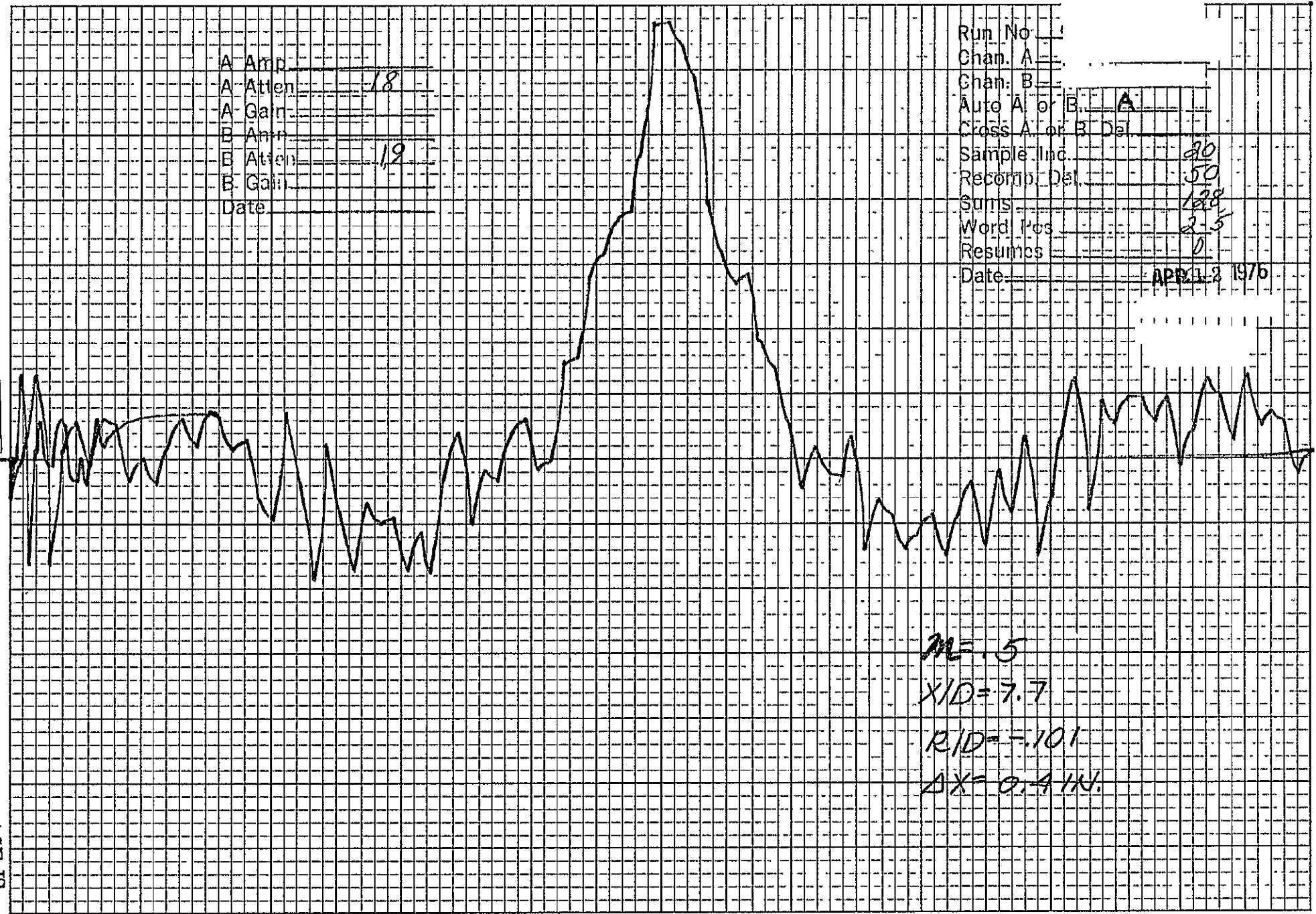
D-163

$M = .5$
 $X/D = 3.0$
 $R/D = .586$
 $\Delta X = 2.4 IN.$

C-3

A Amp _____
A Atten 18
A Gain _____
B Amp _____
B Atten 12
B Gain _____
Date _____

Run No _____
Chan. A _____
Chan. B _____
Auto A or B A
Cross A or B Del _____
Sample Inc. 80
Record Del 50
Suns 128
Word Pos 2-5
Resumes 0
Date APR 12 1976



ME = .5
X/D = 7.7
R/D = -.101
AX = 0.4 IN.

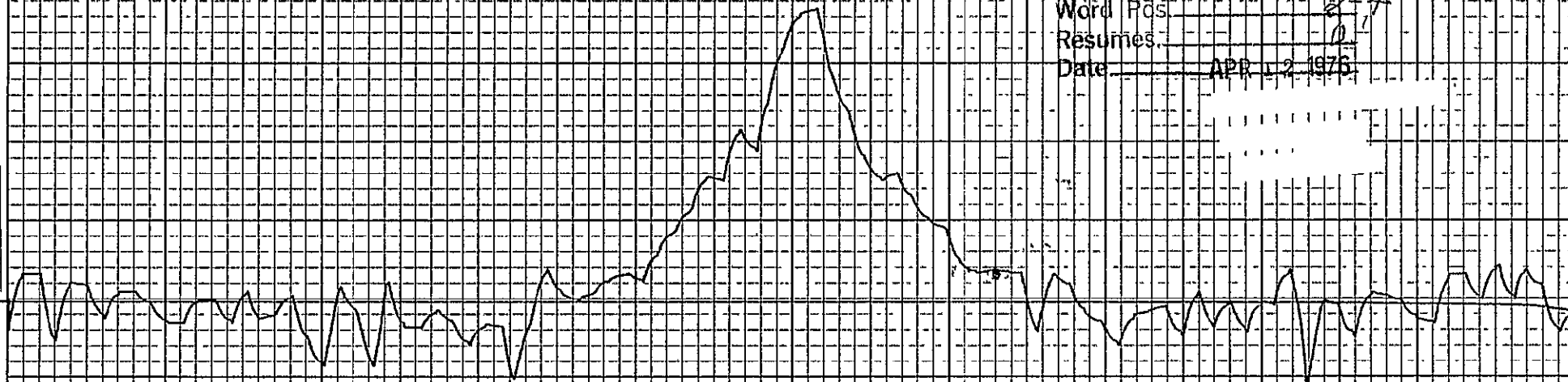
D-164

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 18
A Gain _____
B Amp _____
B Atten 19
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. B
Cross A. or B. Del _____
Sample Inc. 20
Recomp. Del. 30
Summs 128
Word Pcs 2-4
Resumes 0
Date APR 12 1976

D-165

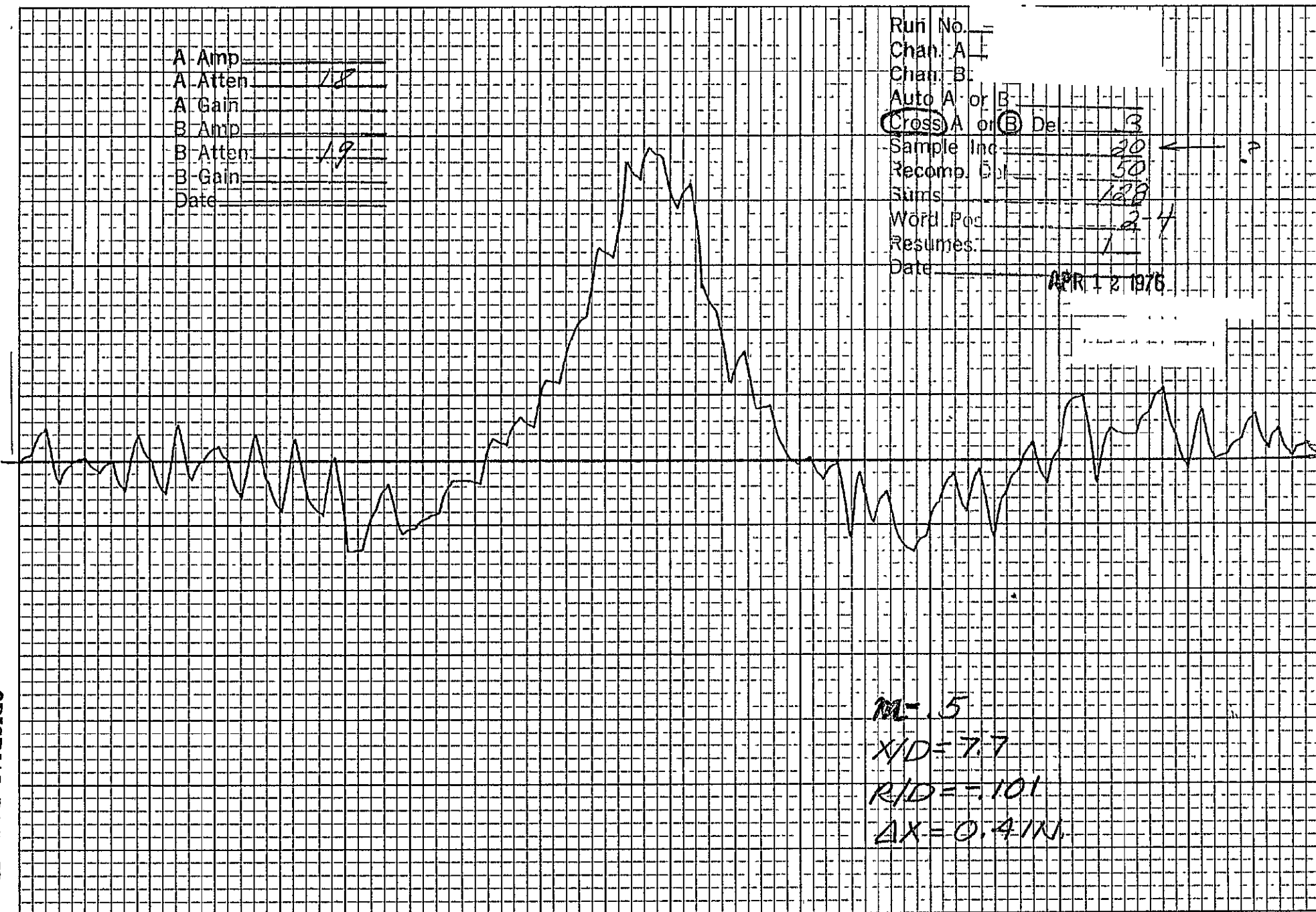


$M = 1.5$
 $X/D = 7.7$
 $R/D = 7.101$
 $\Delta X = 0.4 \text{ IN.}$

A Amp _____
A Atten 18
A Gain _____
B Amp _____
B Atten 19
B Gain _____
Date _____

Run No. _____
Chan. A ☒
Chan. B _____
Auto A or B _____
☒ Cross A or ☒ B De: 13
Sample Inc: 20 ← ?
Recomp. Cl: 50
Sums 128
Word Pos: 2-4
Resumes: 1
Date APR 12 1976

D-166

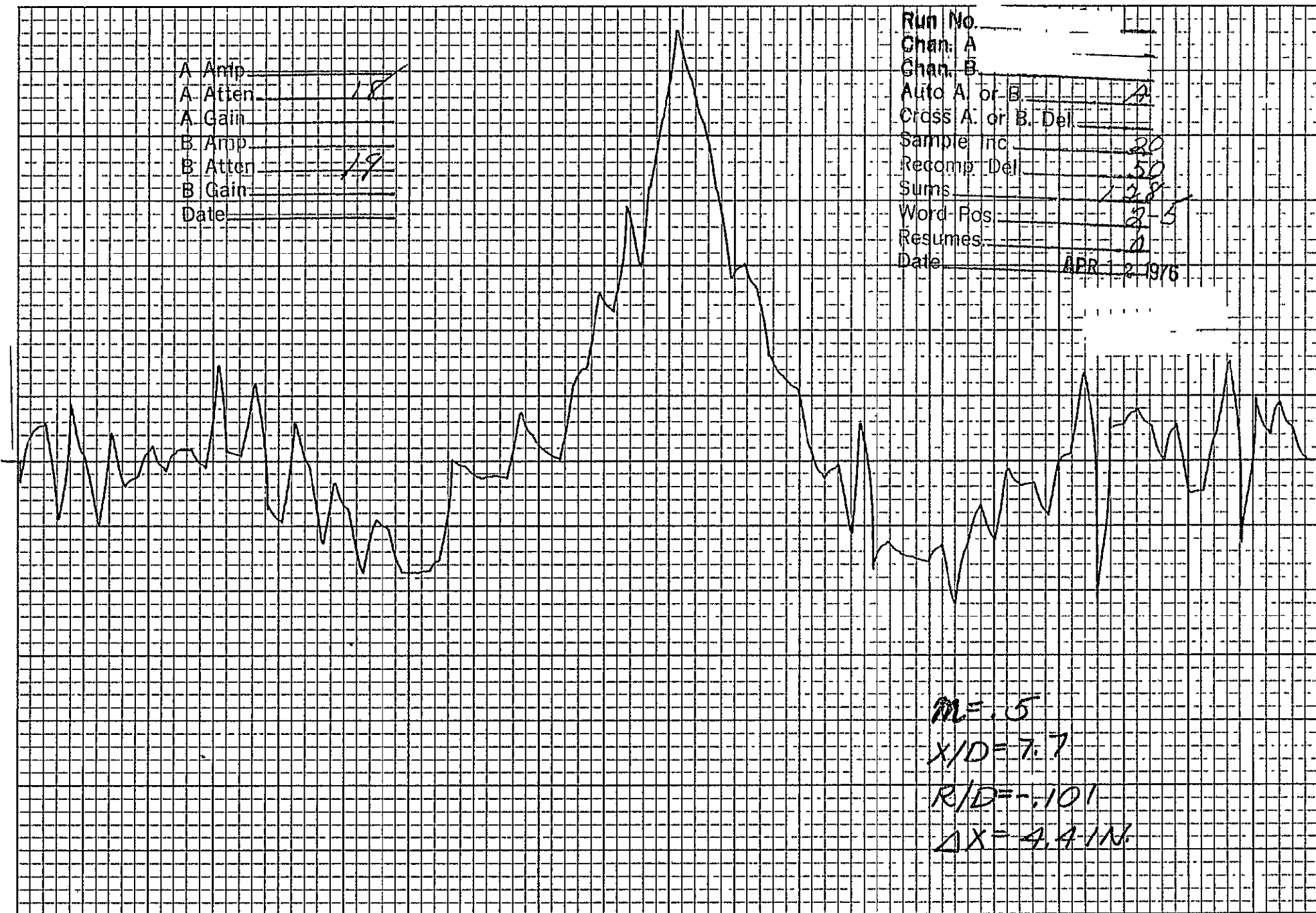


$M = .5$
 $X/D = 7.7$
 $R/D = .101$
 $\Delta X = 0.4/W$

A Amp _____
A Atten 18
A Gain _____
B Amp _____
B Atten 19
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. A
Cross A. or B. Del. _____
Sample Inc. 20
Recomp. Del. 50
Sums 128
Word Pos. 2-5
Resumes 0
Date APR 12 1976

D-167

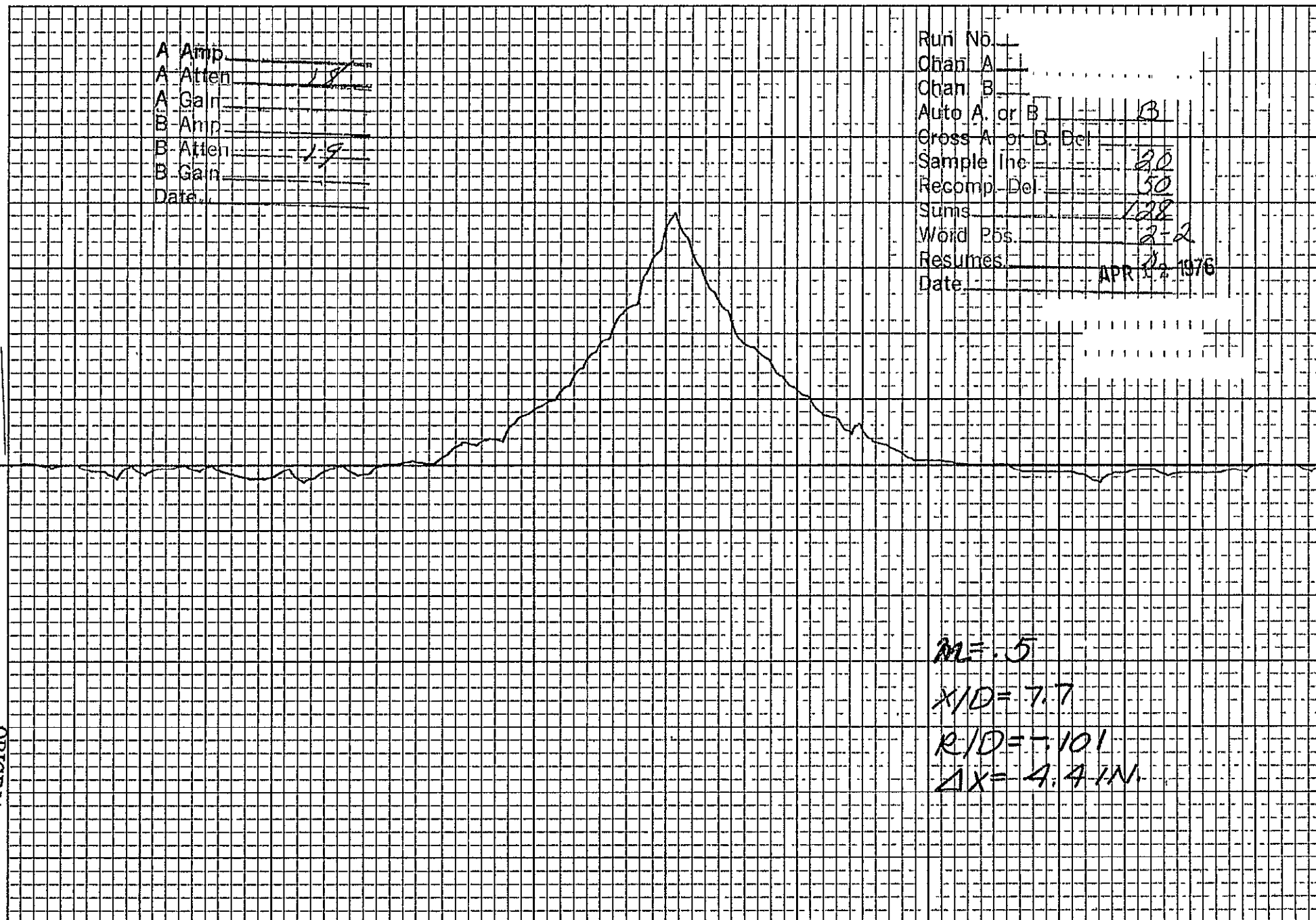


$M = .5$
 $X/D = 7.7$
 $R/D = -.101$
 $\Delta X = 4.4 IN.$

A Amp _____
A Atten 1.7
A Gain _____
B Amp _____
B Atten 1.7
B Gain _____
Date _____

Run No. _____
Chan A _____
Chan B _____
Auto A. or B. B
Cross A. or B. Del _____
Sample Inc. 20
Recomp. Del. 50
Sumis 128
Word Pss. 2-2
Resumes _____
Date APR 12 1976

D-168



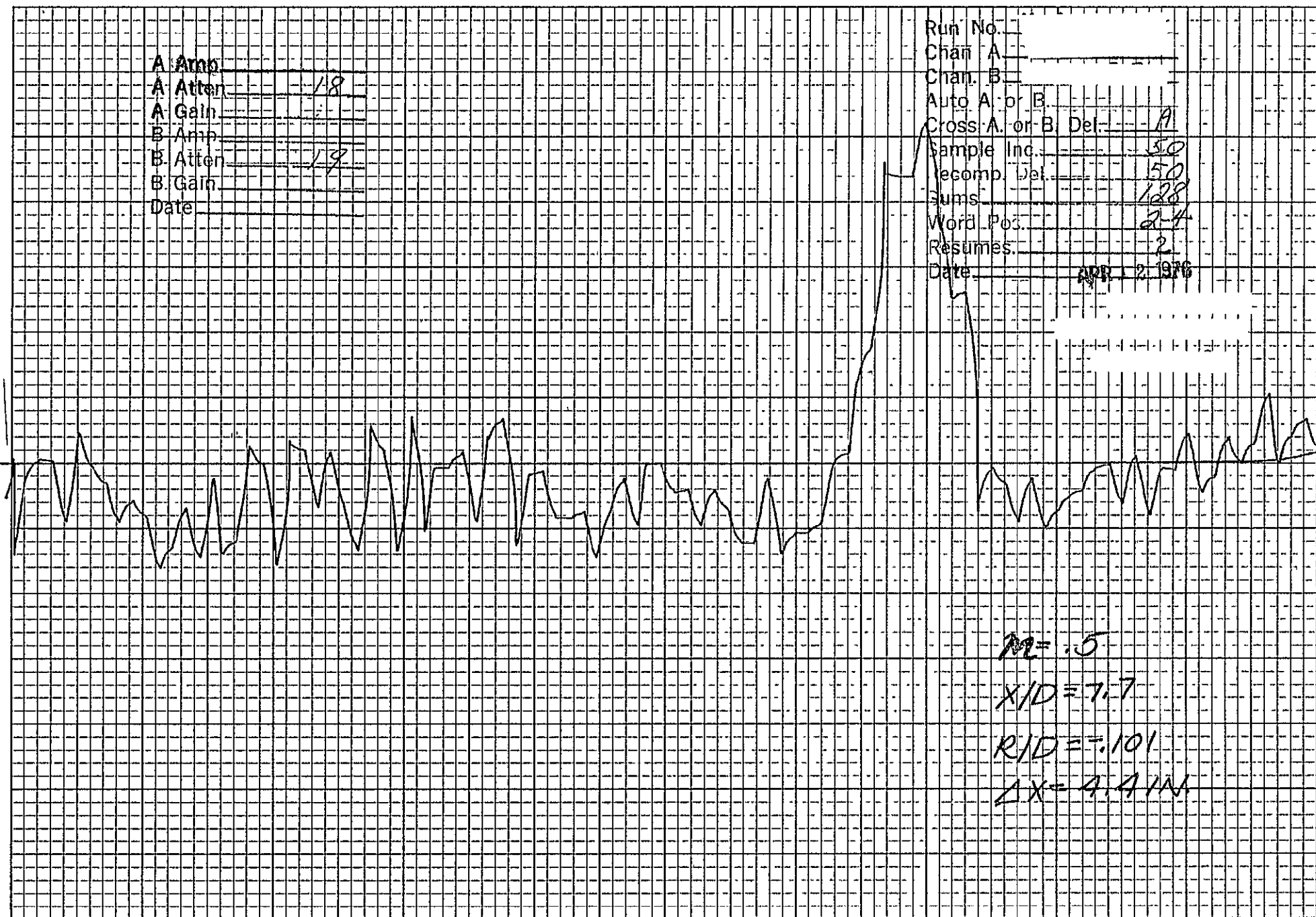
$M = .5$
 $X/D = 7.7$
 $R/D = .101$
 $\Delta X = 4.4 \text{ IN.}$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp
A Atten 18
A Gain
B Amp
B Atten 18
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A or B
Cross A or B Def. A
Sample Inc. 50
Recomp. Def. 50
Sums 128
Word Pos. 24
Resumes 2
Date APR 12 1976

D-169



$$M = .5$$

$$X/D = 7.7$$

$$R/D = .101$$

$$\angle X = 4.41M$$

A Amp _____
A Atten 1.2
A Gain _____
B Amp _____
B Atten 1.9
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B 13
Cross A or B Del _____
Sample Inc 20
Recomp Del 40
Sums 128
Word Pos 2-2
Resumes 0
Date APR 1 8 1976

D-170

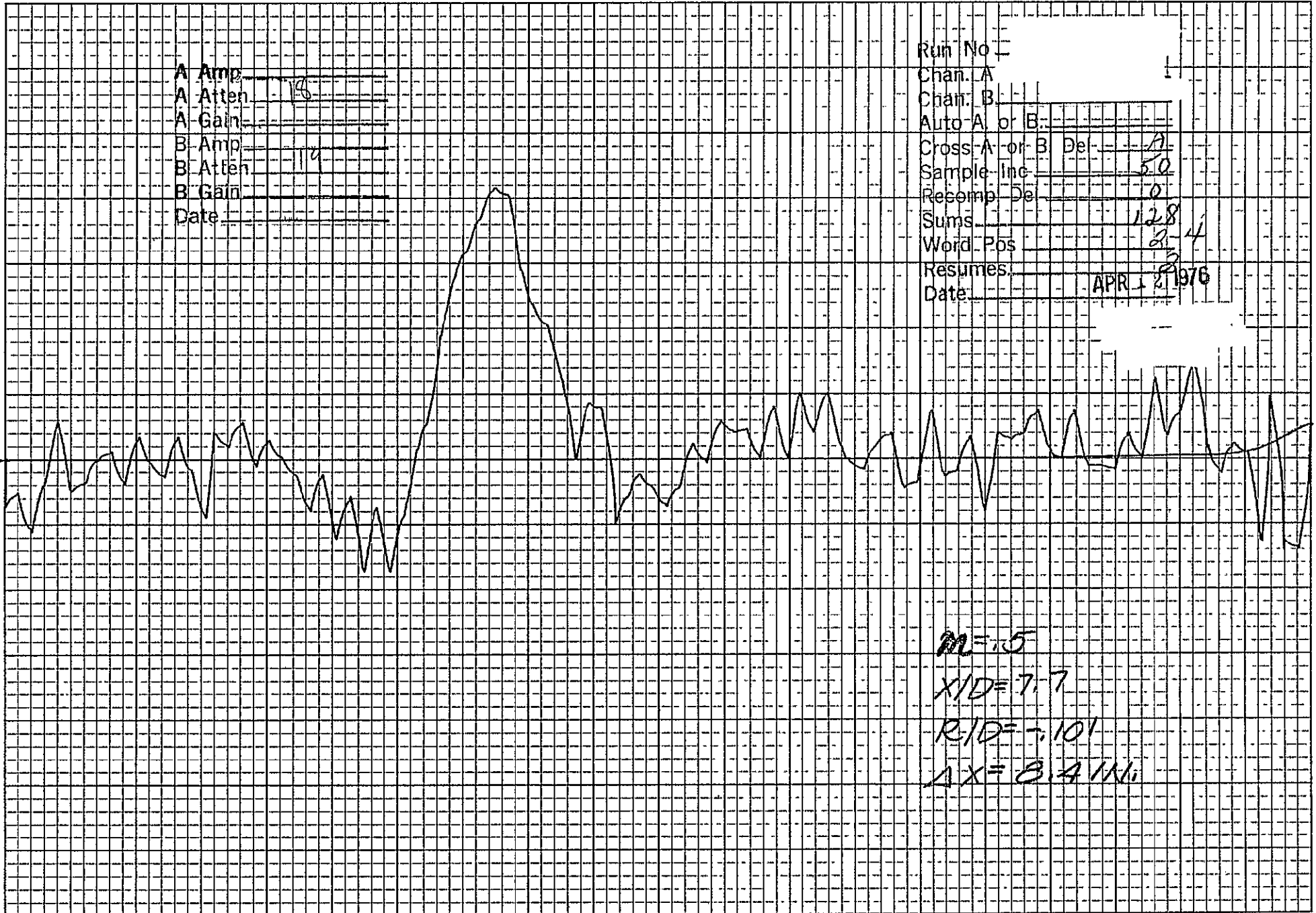
$M = .5$
 $X/D = 7.7$
 $R/D = -.101$
 $\Delta X = 8.4 / N$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 16
A Gain _____
B Amp _____
B Atten 14
B Gain _____
Date _____

Run No _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B De A
Sample Inc 50
Recomp De 0
Sums 128
Word Pos 2 4
Resumes _____
Date APR 2 1976

D-171

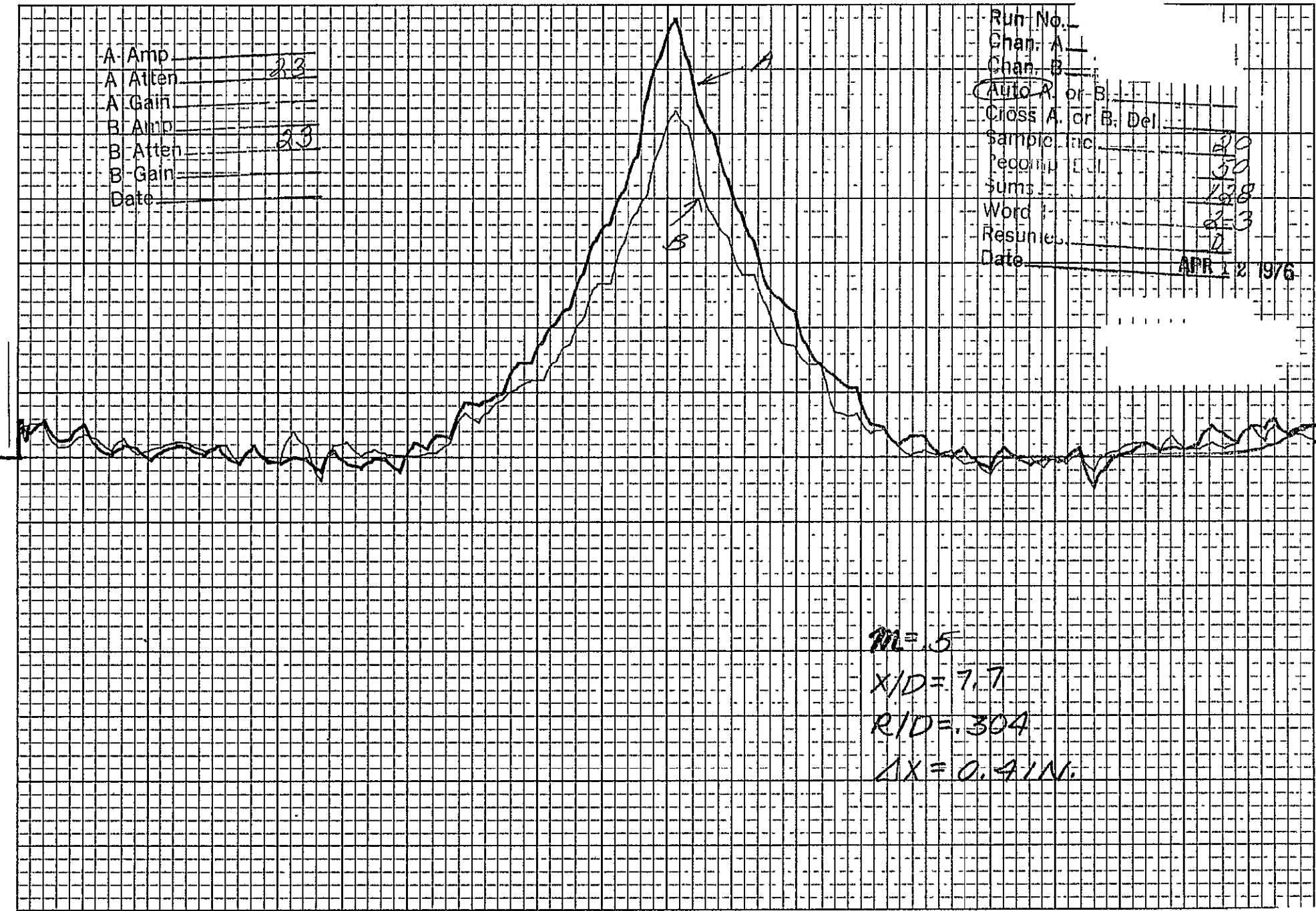


$M = 1.5$
 $X/D = 7.7$
 $R/D = 1.101$
 $\Delta X = 8.4 \text{ Mm}$

A Amp _____
A Atten 2.3
A Gain _____
B Amp _____
B Atten 2.3
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A. or B. Del. _____
Sample Inc. 20
Record ECL 50
Sum 128
Word 2-3
Resuncl. 0
Date APR 12 1976

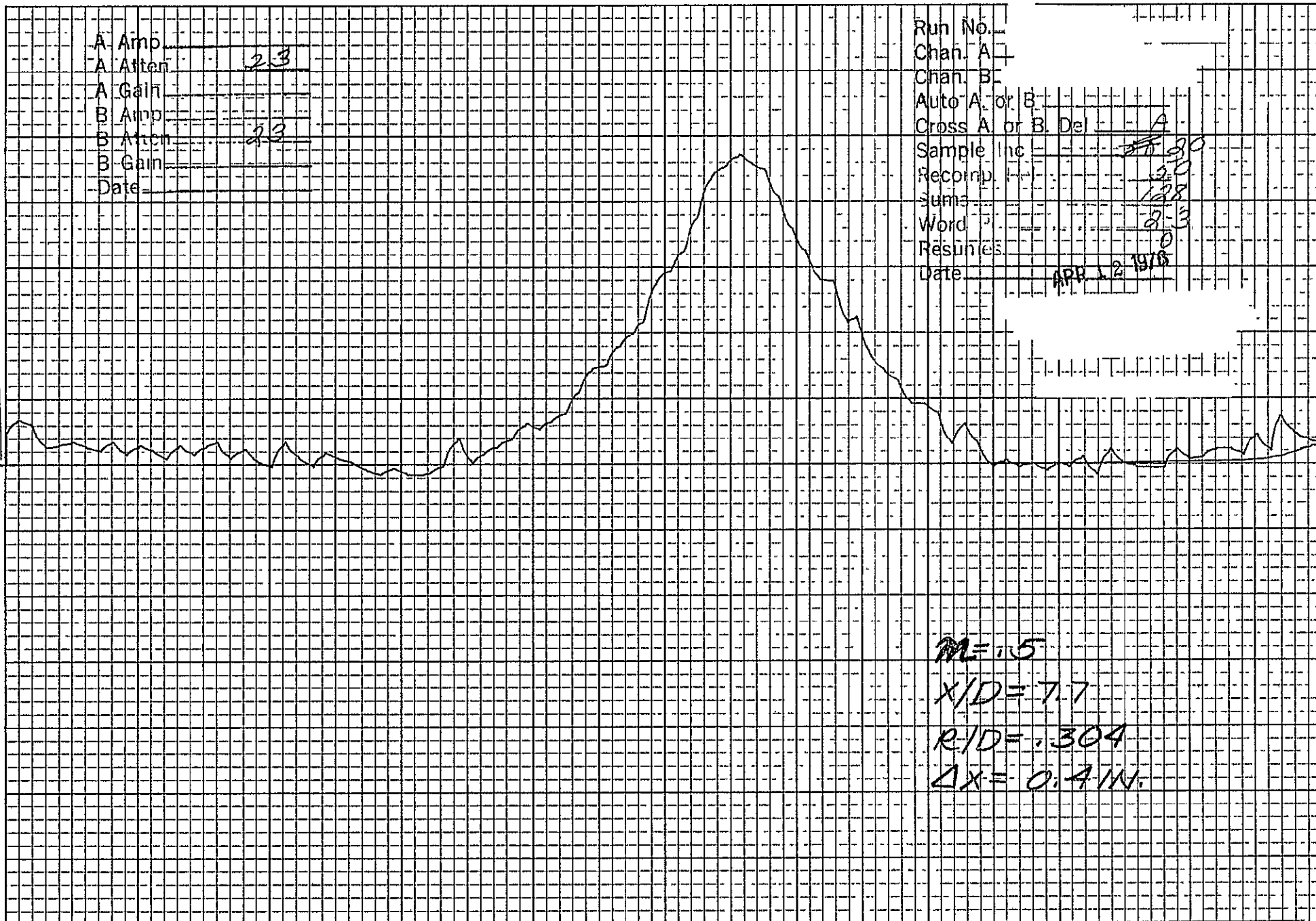
D-172



$M = 5$
 $X/D = 7.7$
 $R/D = .304$
 $\Delta X = 0.41 \text{ IN.}$

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B. Del A
Sample Inc 80
Recomp. 30
Sum 128
Word 8-3
Resunies 0
Date APR 12 1978



$M=1.5$
 $X/D=7.7$
 $R/D=.304$
 $\Delta x=0.4 \text{ in.}$

D-173

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

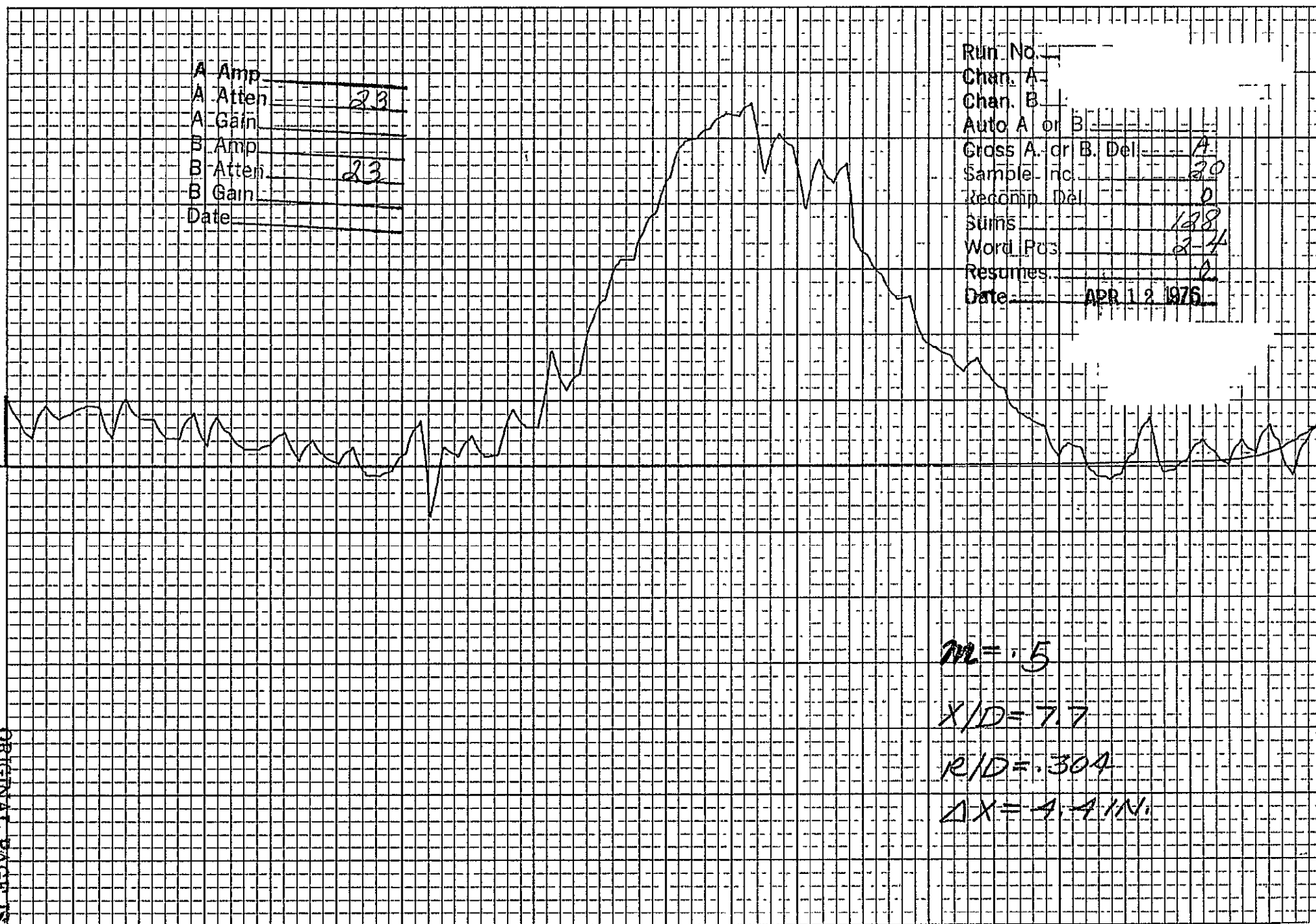
Run No. _____
Chan. A _____
Chan. B _____
Auto. A. or B. B
Cross A. or B. Del. _____
Sample Inc. 20
Recomp. Del. 50
Sums 128
Word Pos. 2-3
Res. times 0
Date SEP 12 1976

D-174

$M = .5$
 $X/D = 7.7$
 $R/D = .304$
 $AX = 1.4 IN.$

A Amp
A Atten 23
A Gain
B Amp
B Atten 23
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A or B
Gross A. or B. Del 4
Sample Inc. 20
Recomp. Del 0
Sum 128
Word Puz 2-4
Resumes 2
Date APR 12 1975



$m = .5$
 $X/D = 7.7$
 $R/D = .304$
 $\Delta X = 4.41N$

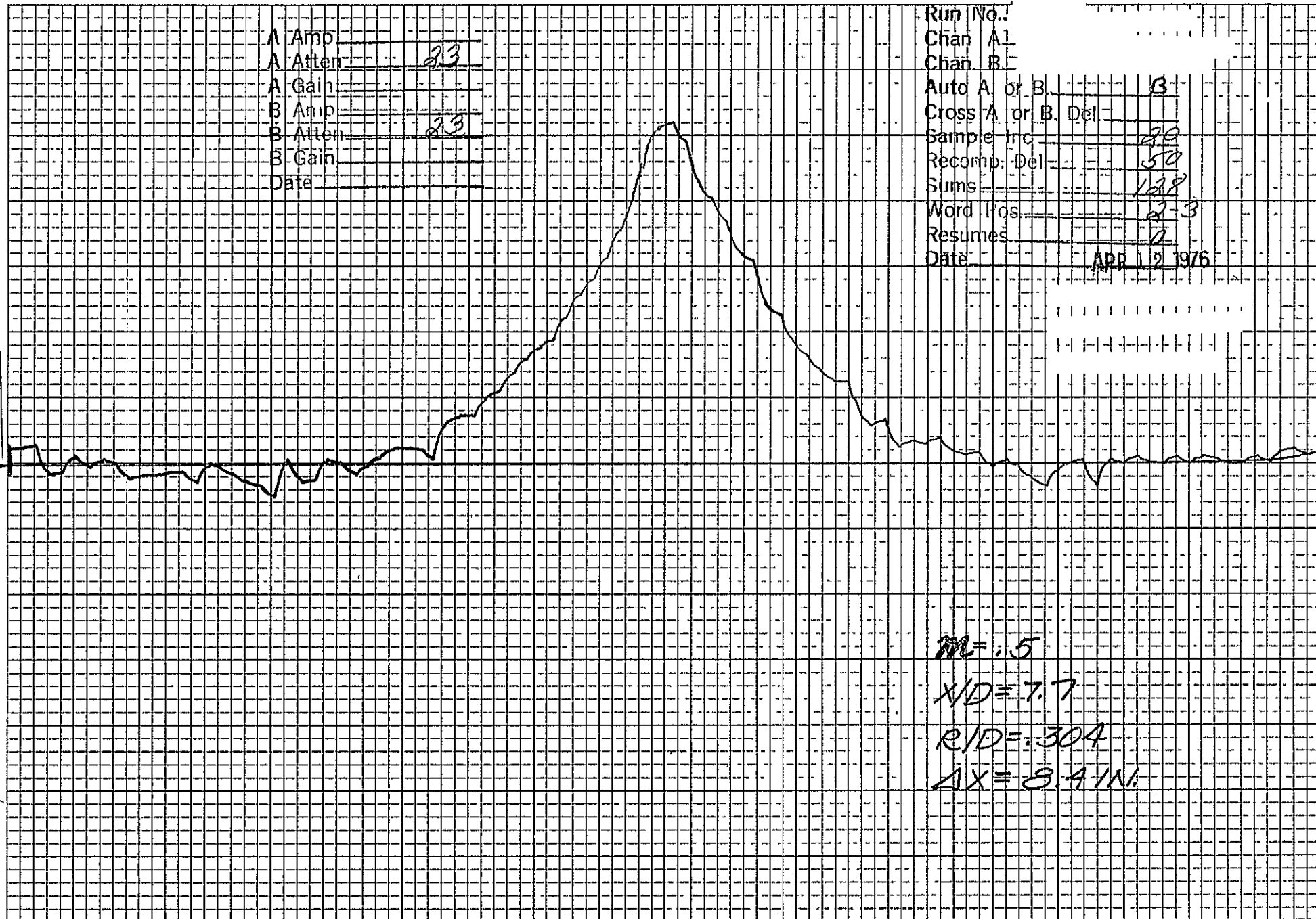
D-175

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No. _____
Chan A _____
Chan B _____
Auto A or B B
Cross A or B Del _____
Sample Inc 20
Recomp Del 50
Sums 128
Word Hcs 2-3
Resumes 0
Date APR 12 1976

D-176



A Amp _____
A Atten 2.3
A Gain _____
B Amp _____
B Atten 2.3
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A. or B Del A
Sample Inc. 50
Record. Del 0
Sums 128
Word Pcs. 2-4
Resumes _____
Date APR 12 1976

D-177

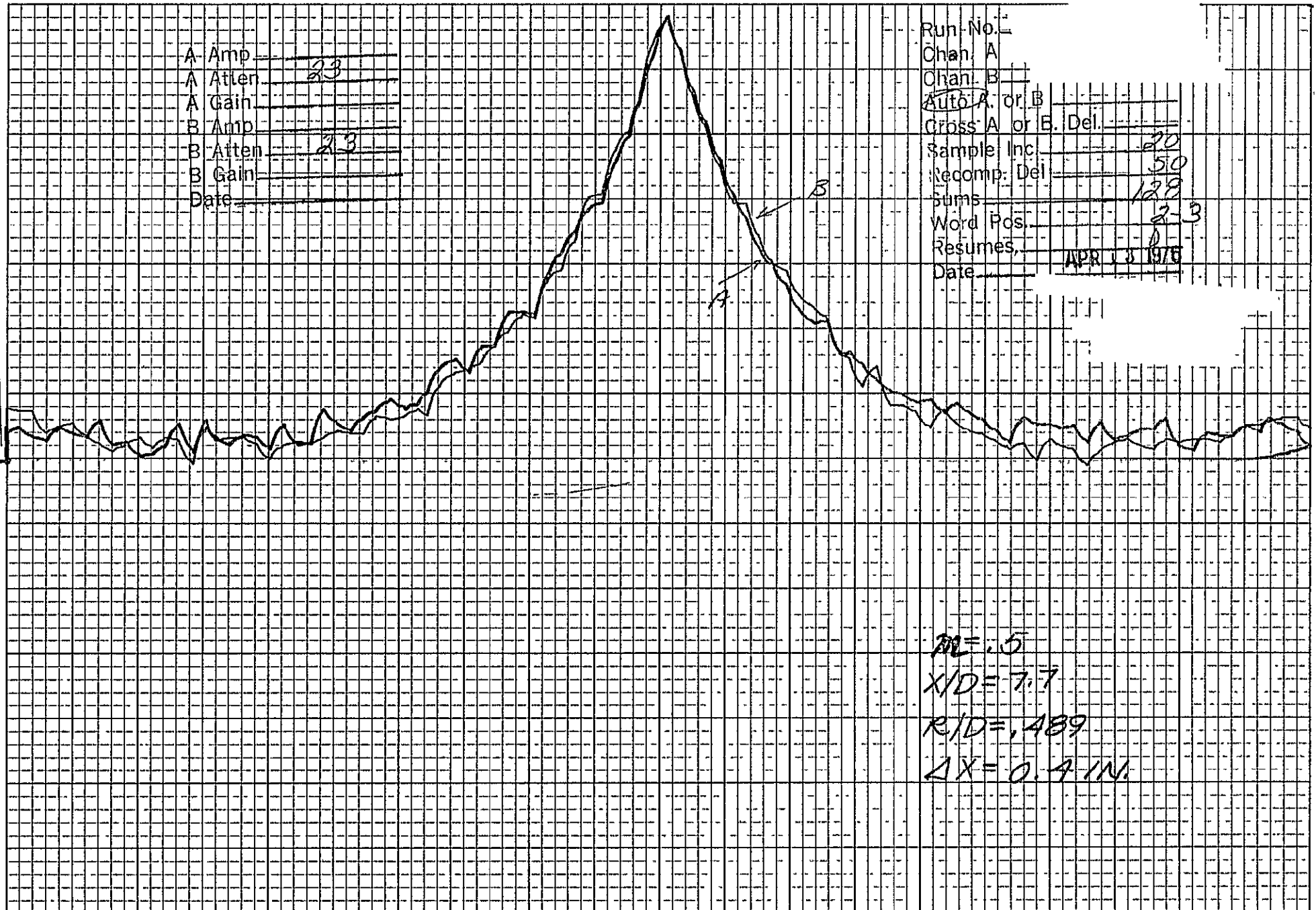
$m = .5$
 $X/D = 7.7$
 $R/D = .304$
 $\Delta X = 8.41N$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
~~Auto~~ A or B _____
Cross A or B Del. _____
Sample Inc. 20
Recomp. Del. 50
Sums 128
Word Pos. 2-3
Resumes. 1
Date APR 13 1976

D-178



$RL = .5$
 $X/D = 7.7$
 $R/D = .489$
 $\Delta X = 0.4 \text{ IN.}$

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

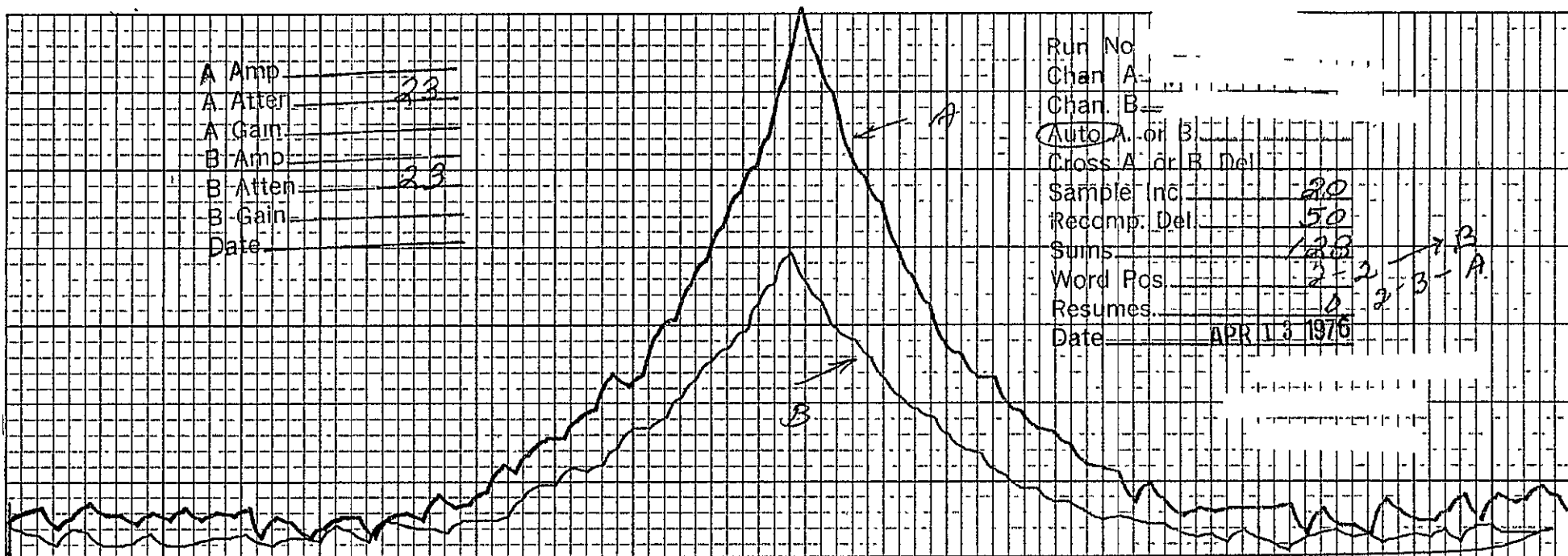
Run No. _____
Chan. A ☐
Chan. B ☐
Auto A or B _____
Cross A. or B. Del A
Sample Inc 20
Recomp. Del 50
Sums 128
Word Pos. 2-3
Resumes 0
Date APR 13 1976

D-179

$M = .5$
 $X/D = 7.7$
 $R/D = .489$
 $\Delta X = 0.4 IN.$

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

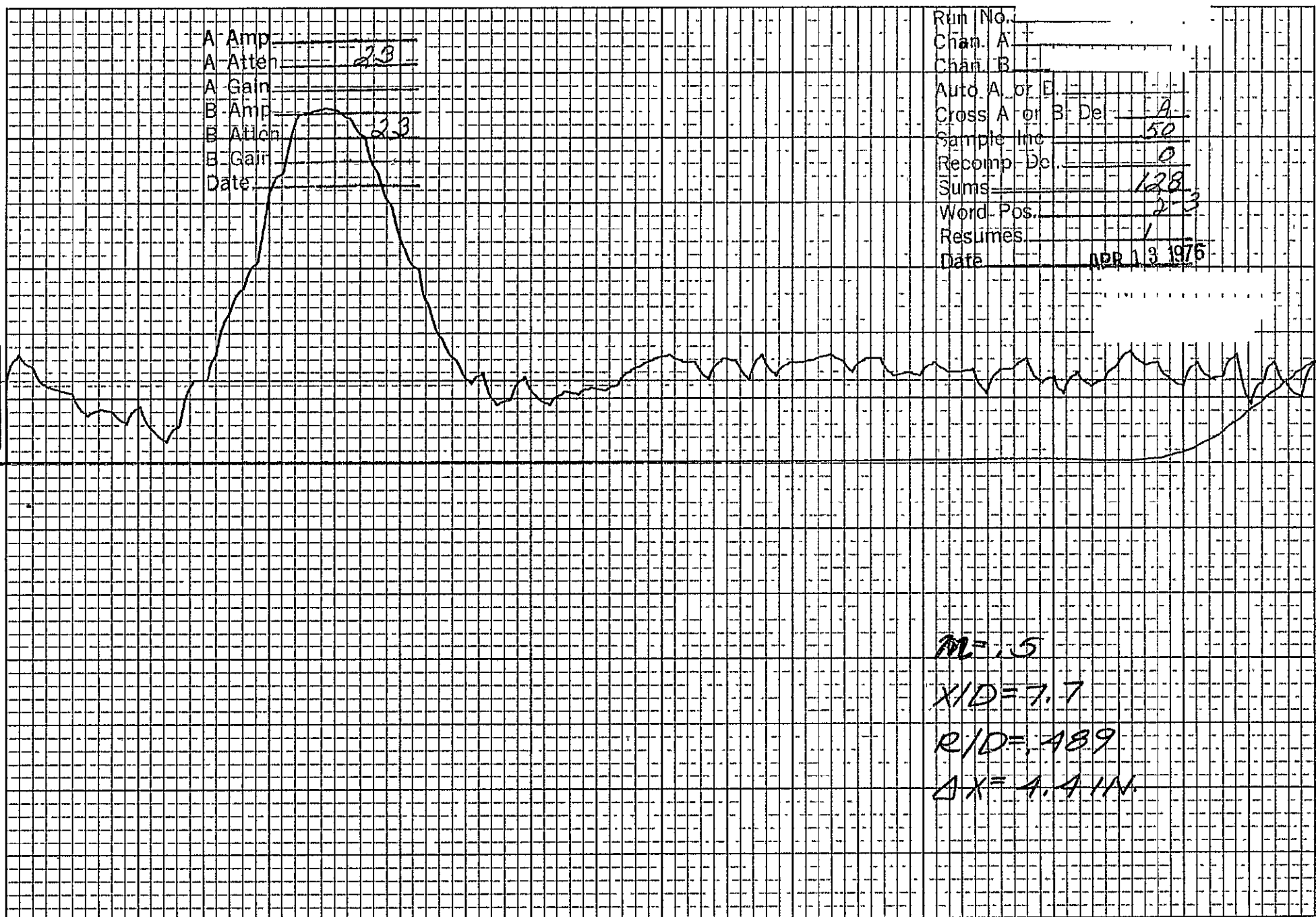
Run No _____
Chan A _____
Chan B _____
Auto A or B _____
Cross A or B Del _____
Sample Inc 20
Recamp Del 50
Sums 123
Word Pos 2 2 2 3 A
Resumes 0
Date APR 13 1970



$M = .5$
 $X/D = 7.7$
 $R/D = .489$
 $\Delta X = 4.4/N$

A Amp _____
A Atten. 2.3
A Gain _____
B Amp _____
B Atten. 2.3
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del. A
Sample Inc. 50
Recomp. Do. 0
Sums 128
Word Pos. 2.3
Resumes 1
Date APR 13 1976



$M = .5$
 $X/D = 7.7$
 $R/D = .489$
 $\Delta X = 4.4 \text{ IN.}$

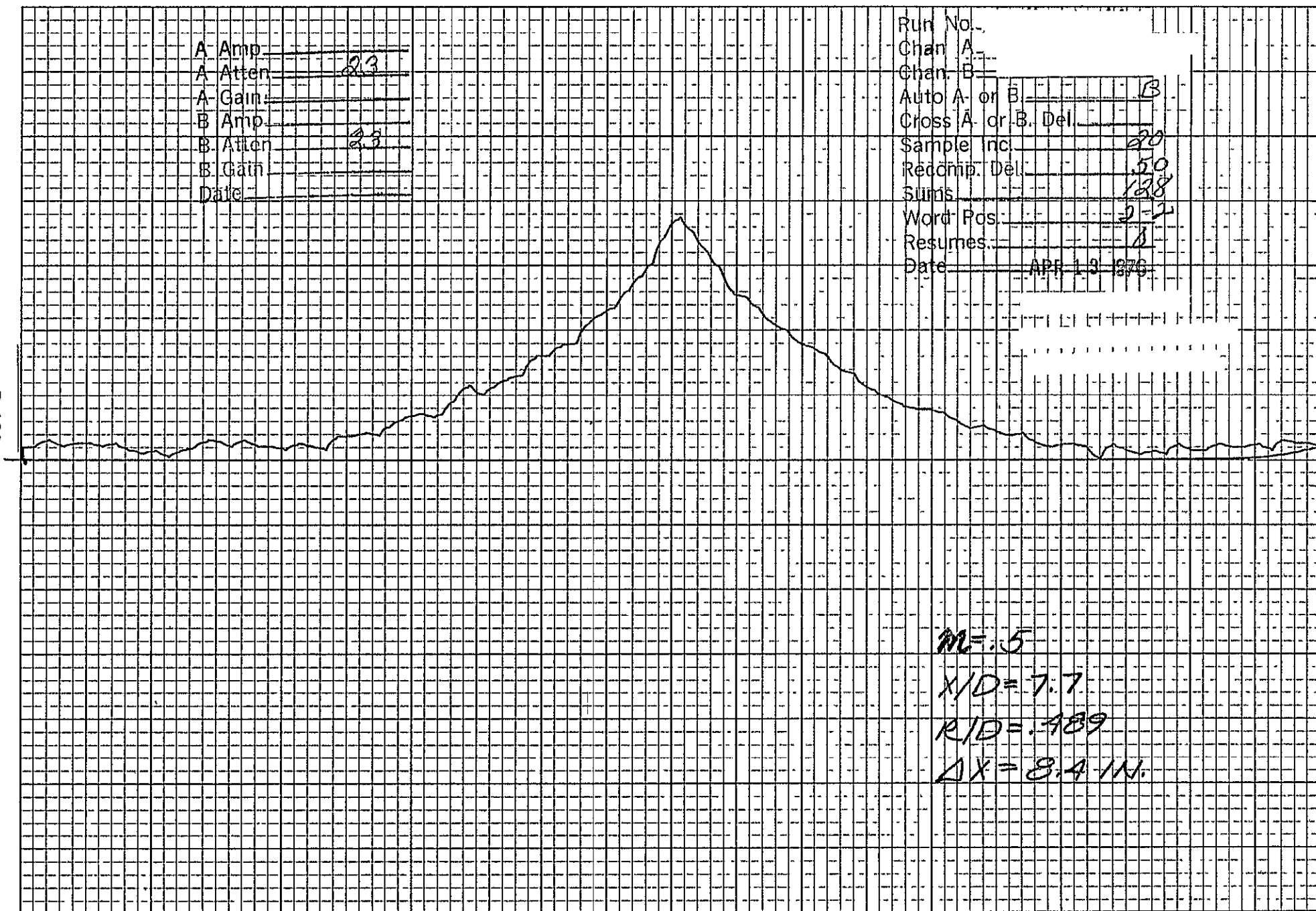
D-181

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No. _____
Chan A _____
Chan B _____
Auto A or B B
Cross A or B Del _____
Sample Inc. 20
Redamp. Del. 50
Sumis 128
Word Pos. 2-2
Resumes 1
Date APR 13 1976

D-182



$M = .5$
 $X/D = 7.7$
 $R/D = .489$
 $\Delta X = 8.4 \text{ IN.}$

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No _____
Chan. A _____
Chan. B _____
Auto A or B _____
Gross A or B Del. 12
Sample Inc. 32
Recomp. Del. 0
Sumis 128
Word Pos. 23
Resumes 1
Date APR 13 1976

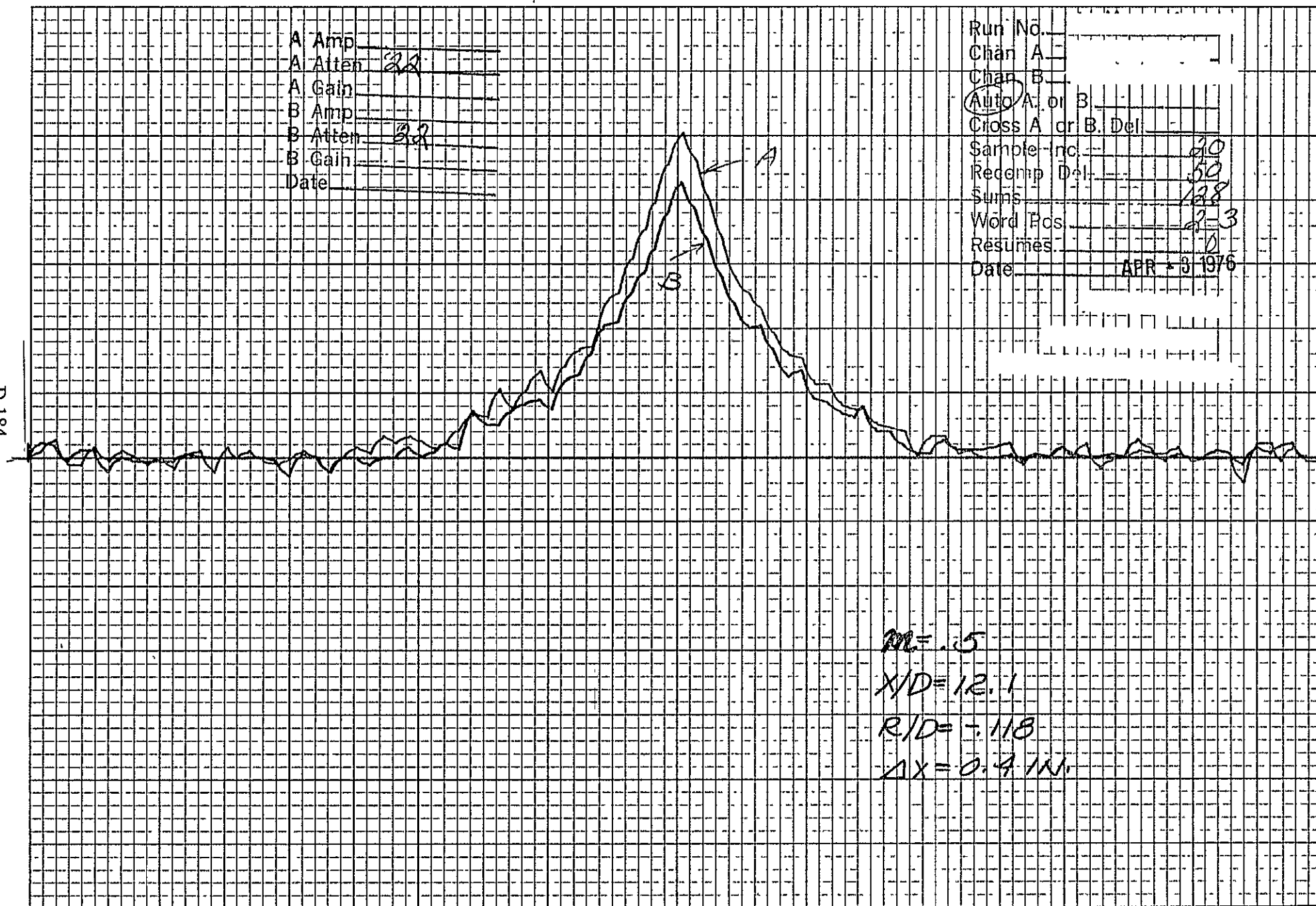
D-183

$M = .5$
 $X/D = 7.7$
 $R/D = .489$
 $\Delta X = 8.4 \text{ IN.}$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 22
A Gain _____
B Amp _____
B Atten 32
B Gain _____
Date _____

Run No. _____
Chan A _____
Chan B _____
Auto A or B _____
Cross A or B Del _____
Sample Inc _____ 20
Recamp Del _____ 50
Summ _____ 128
Word Fcs _____ 2-3
Resumes _____ 0
Date _____ APR 8 1976



A Amp _____
A Atten 2.8
A Gain _____
B Amp _____
B Atten 2.2
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B-De. A
Sample Inc. 20
Recomp. De. 50
Sums 128
Word Pos. 2-3
Resumes 2
Date APR 13 1976

D-185

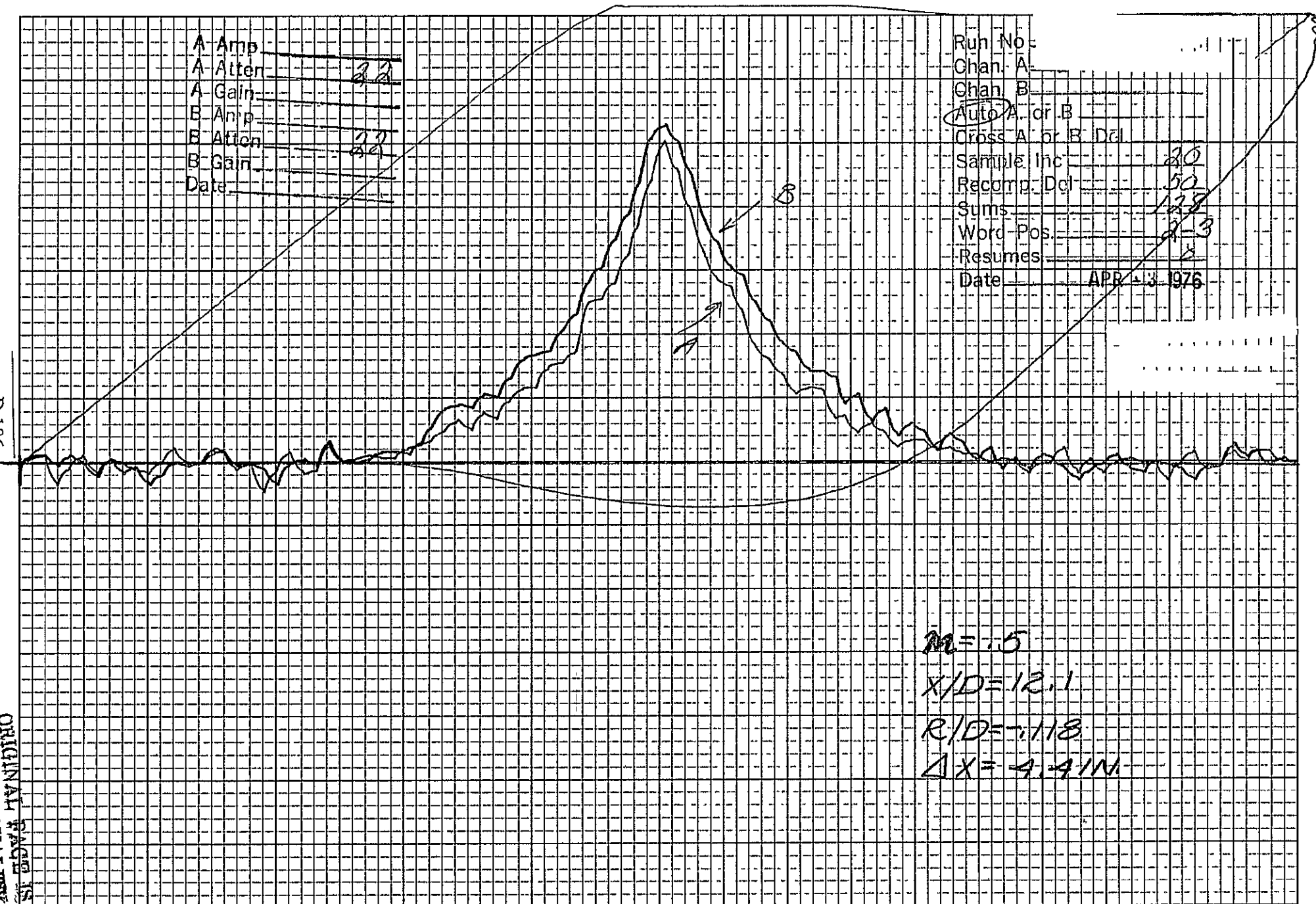


$M = .5$
 $X/D = 12.1$
 $R/D = -.118$
 $\Delta X = 0.4 \text{ IN.}$

A Amp _____
A Attenu _____ 22
A Gain _____
B Amp _____
B Attenu _____ 22
B Gain _____
Date _____

Run No: _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A or B Del _____
Sample Inc _____ 20
Recomp. Del _____ 50
Sum _____ 128
Word Pos _____ 2-3
Resumes _____
Date _____ APR 13 1976

D-186



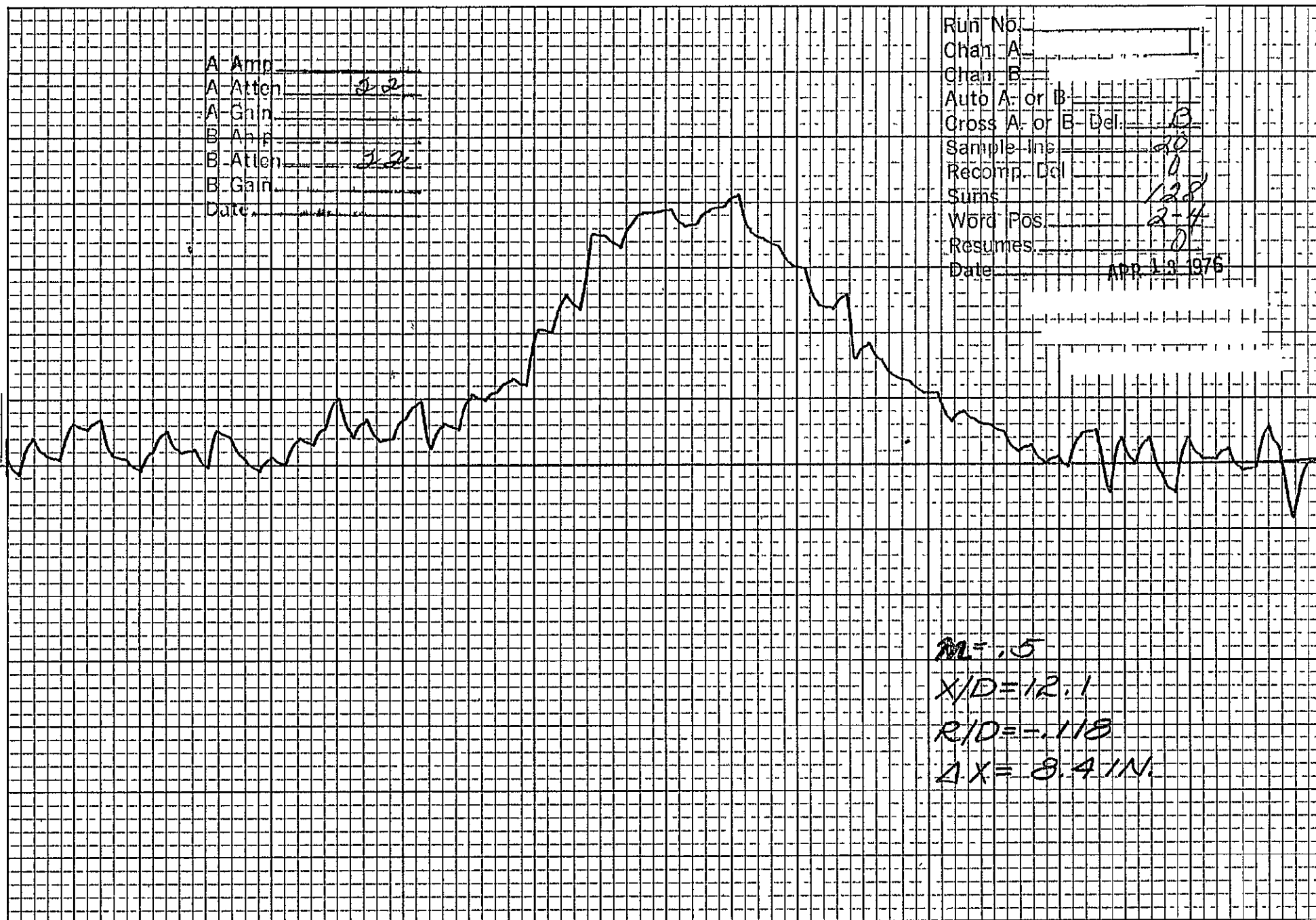
$m = 1.5$
 $X/D = 12.1$
 $R/D = 1.118$
 $\Delta X = 4.41M$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 22
A Gain _____
B Amp _____
B Atten 22
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. B
Sample Inc. 20
Recomp. Del. 0
Sum. 128
Word Pos. 2-4
Resumes. 0
Date Apr 13 1976

D-187

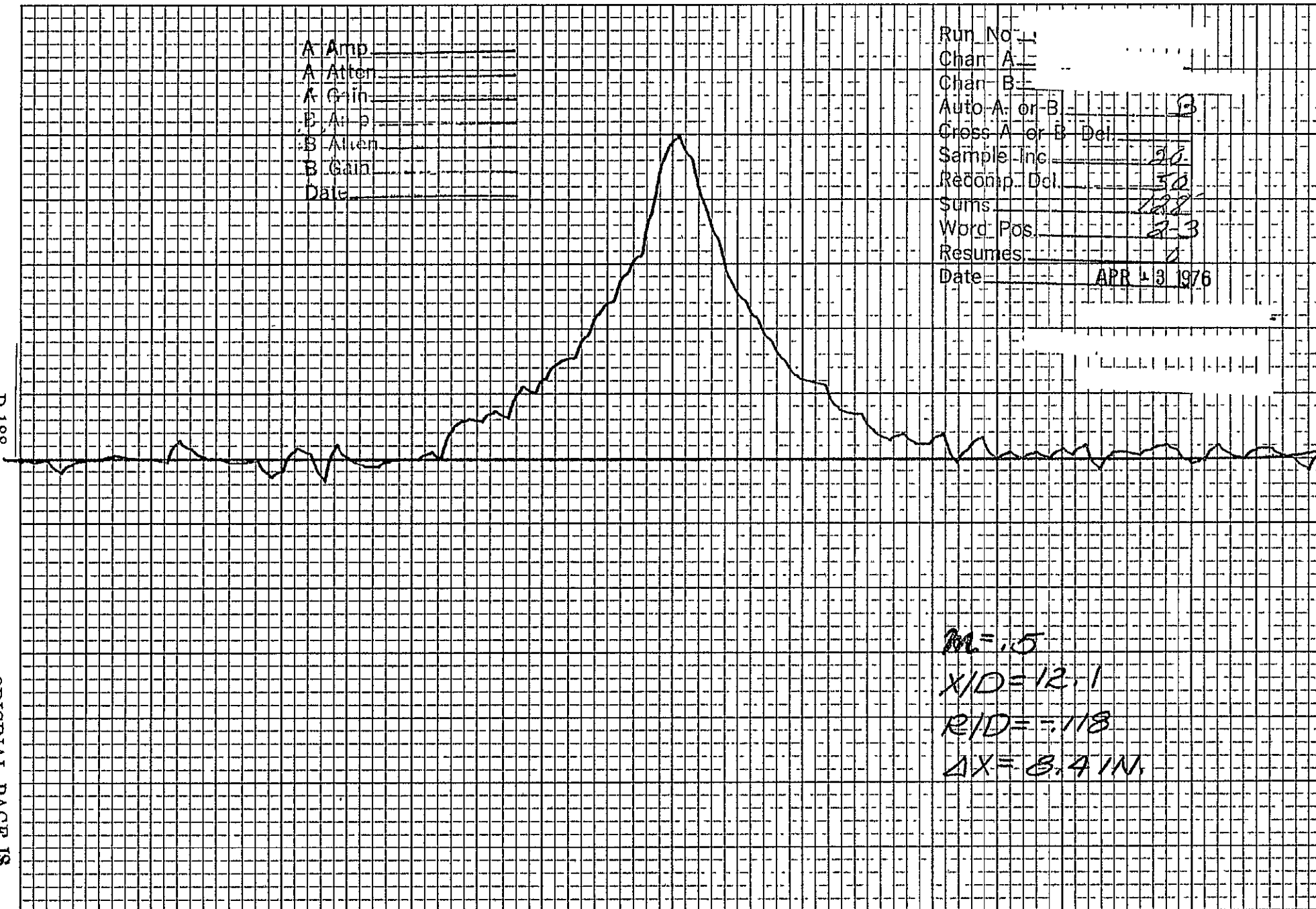


$M = .5$
 $X/D = 12.1$
 $R/D = -.118$
 $\Delta X = 8.4 \text{ IN.}$

A Amp _____
A Atten _____
A Gain _____
B Amp _____
B Atten _____
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto. A or B _____
Cross A or B Del. _____
Sample Inc. _____
Recomp. Del. _____
Summ. _____
Word Pos. _____
Resumes _____
Date _____ APR 13 1976

D-188



$M = 1.5$
 $X/D = 12.1$
 $R/D = 1.118$
 $\Delta X = 8.4 \text{ IN.}$

A Amp. 32
 A Atten 22
 A Gain 22
 F AMP 22
 B Atten 22
 B Gain 22
 Date

Run No.
 Chan. A
 Chan. B
 Auto A. or B.
 Cross A. or B. Del. 14
 Sample Inc. 100
 Recomp. Del. 0
 Sums 128
 Word Pos. 24
 Resumes 1
 Date APR 13 1976

D-189

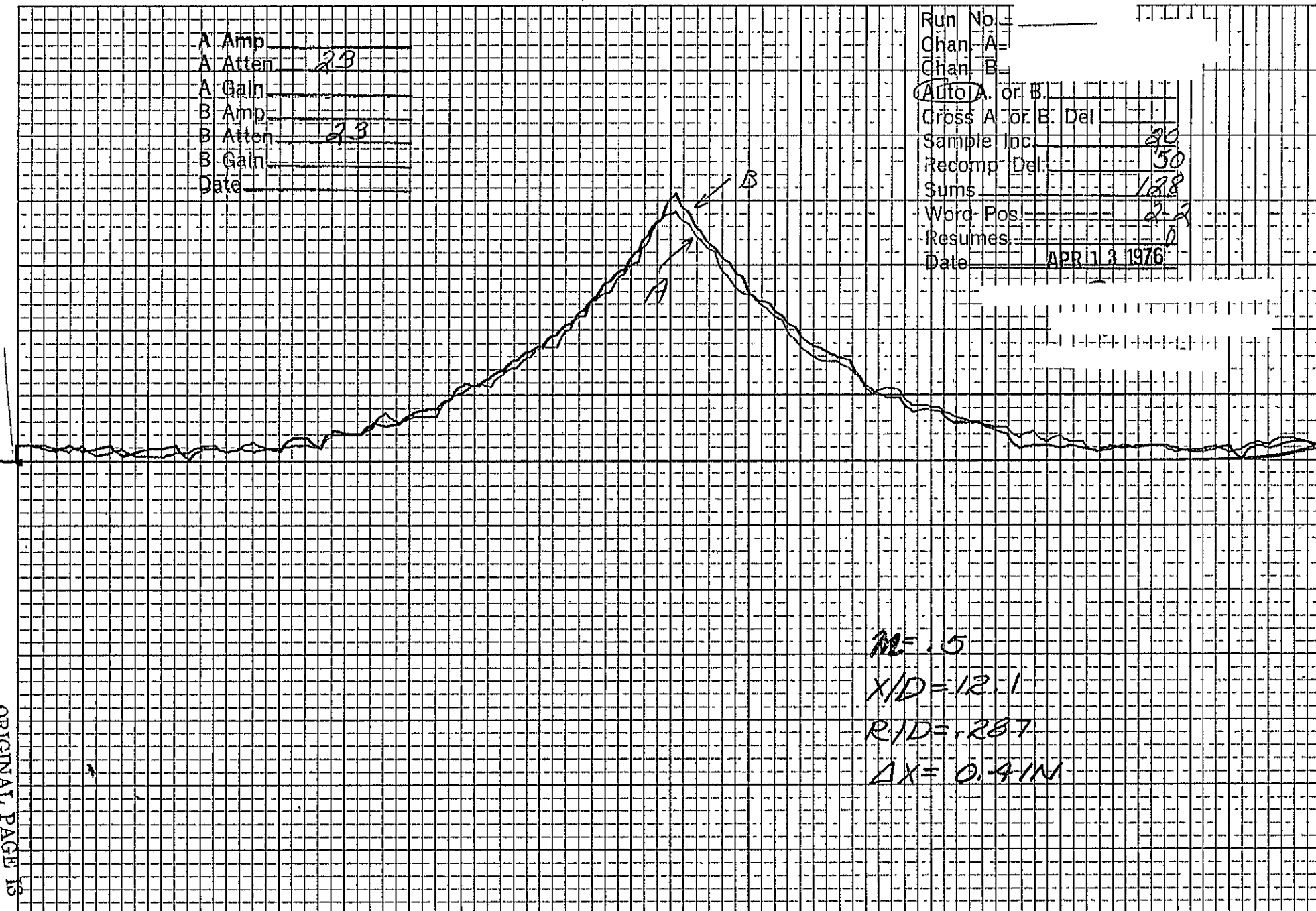


$M = .5$
 $X/D = 12.1$
 $R/D = 118$
 $\Delta X = 8.4 \text{ IN.}$

A Amp
A Atten 23
A Gain
B Amp
B Atten 23
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A. or B.
Cross A. or B. Del.
Sample Inc. 80
Recomp. Del. 30
Sums 128
Word Pos. 2-3
Resumes 0
Date APR 13 1976

D-190



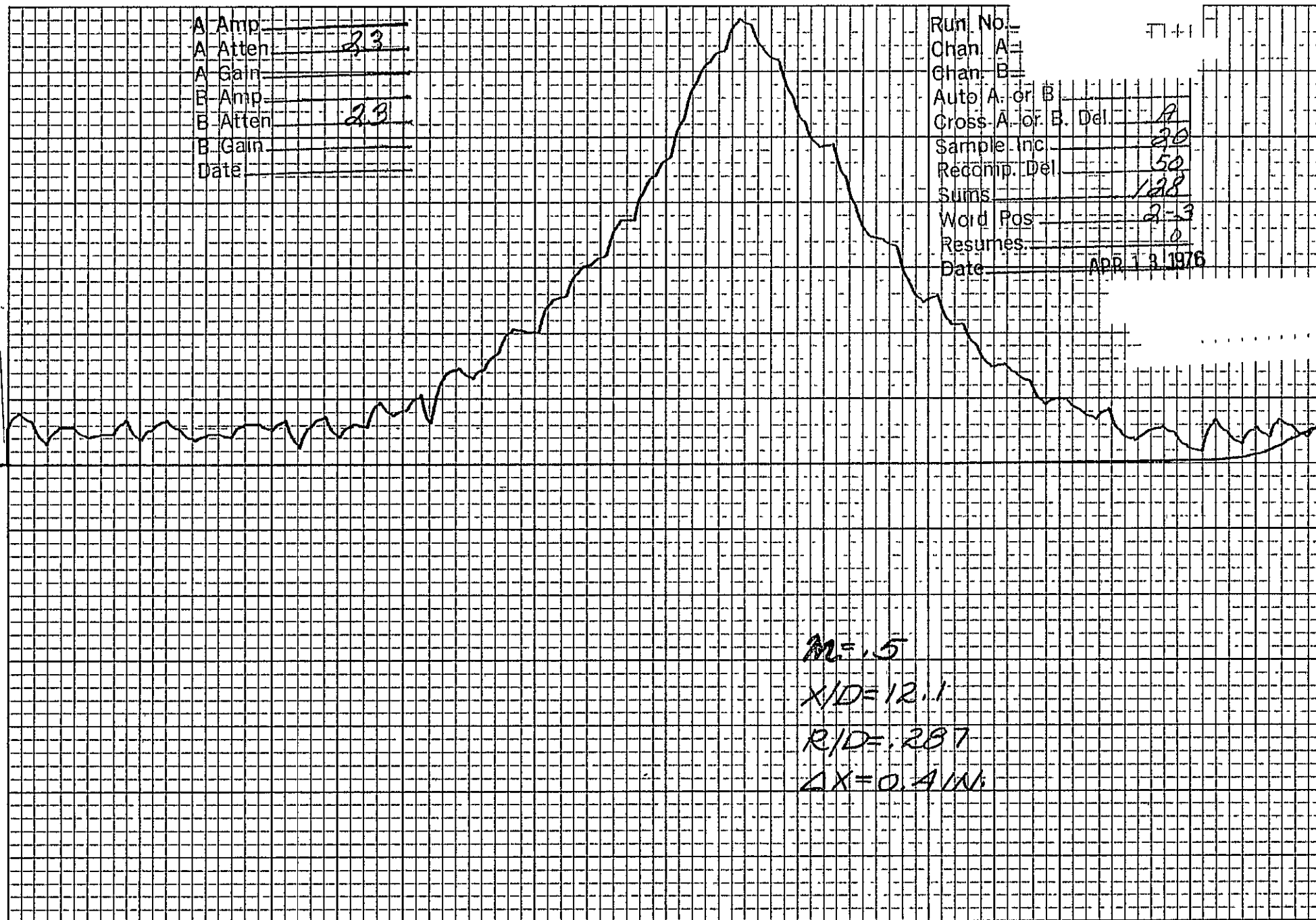
$M = .5$
 $X/D = 12.1$
 $R/D = .287$
 $\Delta X = 0.41M$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No. _____
Chan A _____
Chan B _____
Auto A. or B. _____
Cross A. or B. Del. 2
Sample Inc. 20
Recomp. Del. 50
Sums 128
Word Pos 2-3
Resumes 0
Date APR 13 1976

D-191

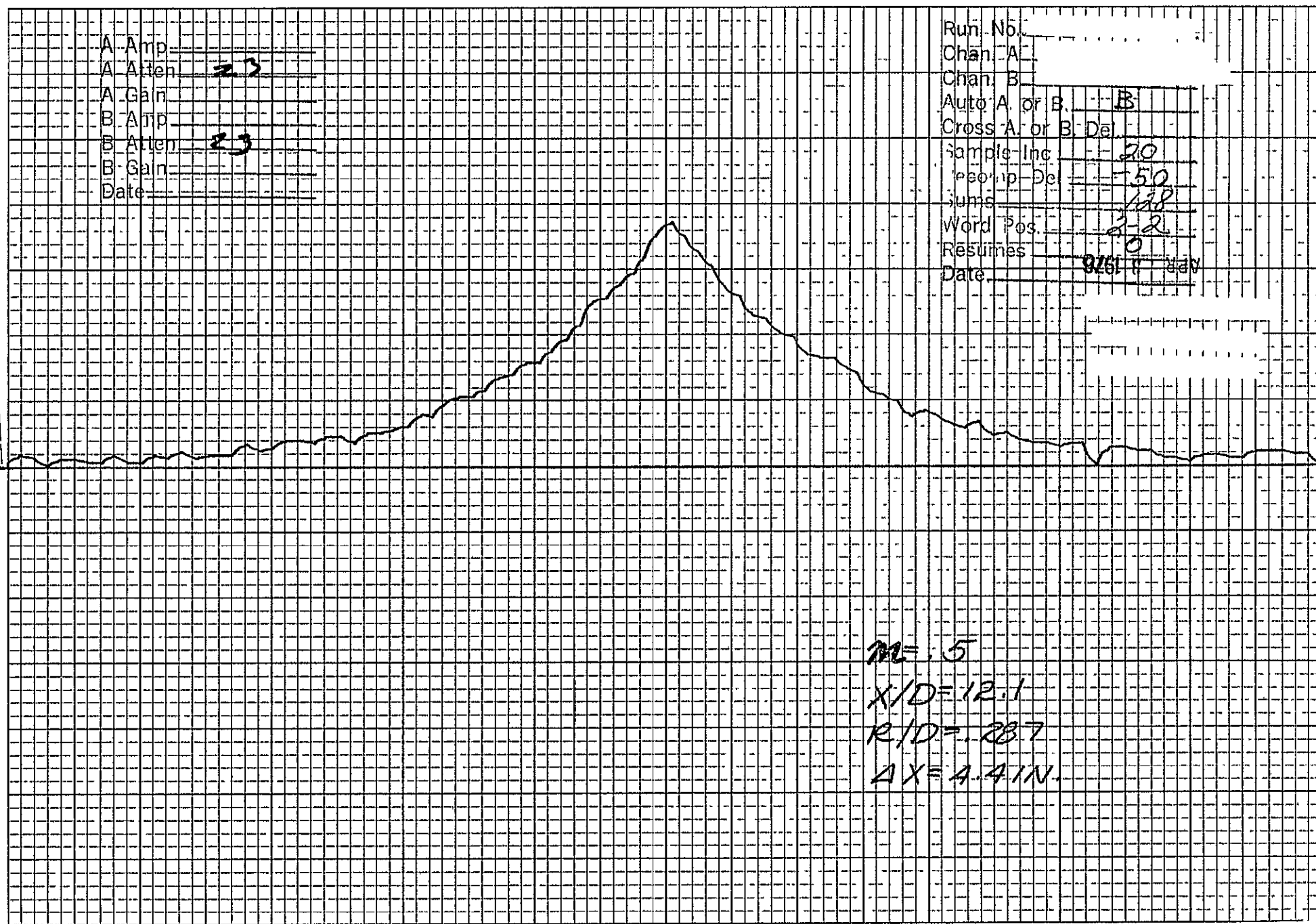


$M = .5$
 $X/D = 12.1$
 $R/D = .287$
 $\Delta X = 0.414$

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. B
Cross A. or B. Del _____
Sample Inc 20
Recorp Del 50
Sums 128
Word Pos. 2-2
Resumes 0
Date 9/26/64

D-192



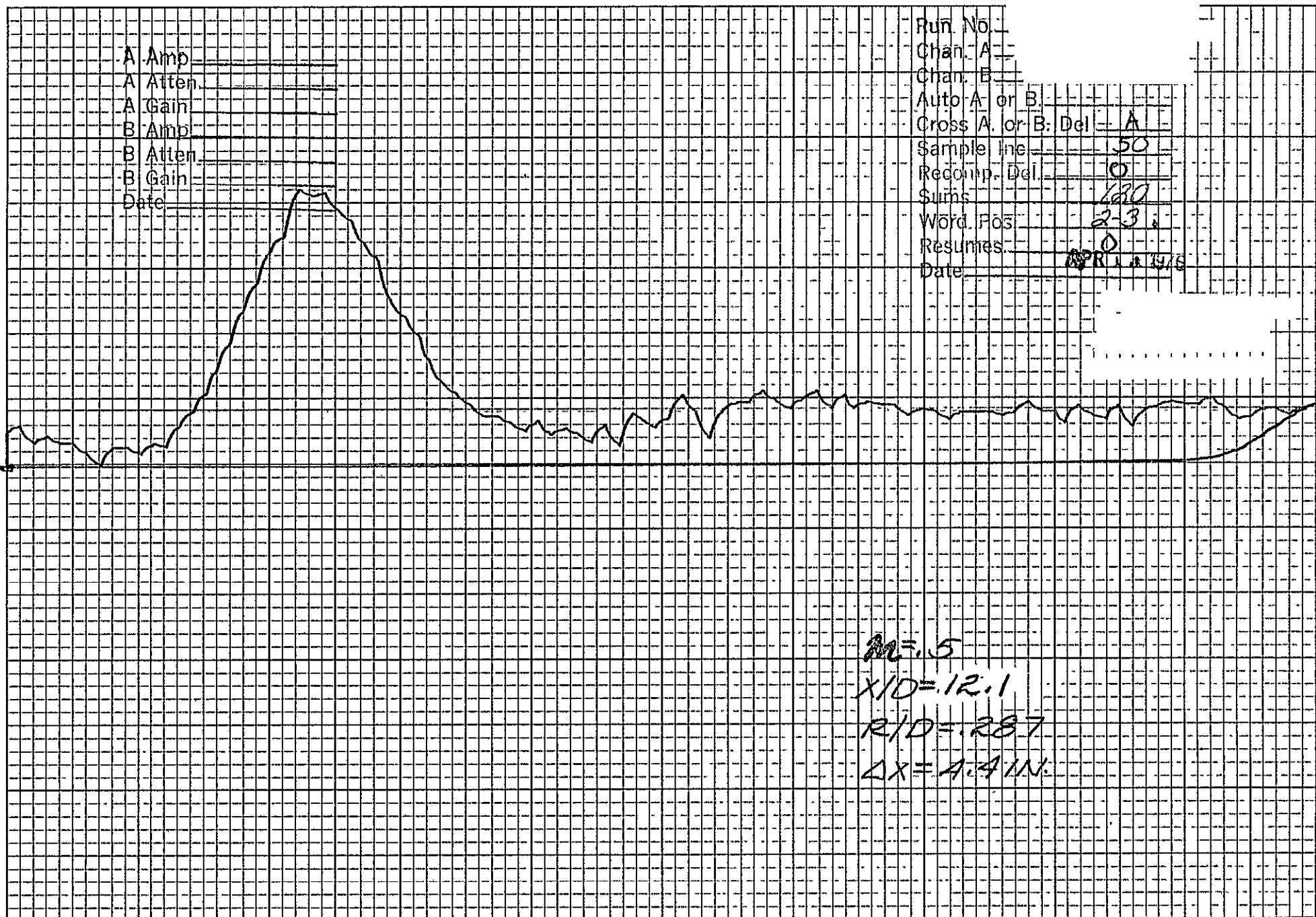
$M = 5$
 $X/D = 12.1$
 $R/D = .287$
 $AX = 4.41N$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp _____
A Atten. _____
A Gain _____
B Amp _____
B Atten. _____
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A or B _____
Cross A. or B: Del. A
Sample Ine. 50
Recomp. Del. 0
Sums 180
Word. Pos. 2-3
Resumes 0
Date APR 1 1976

D-193



$M = 5$
 $X/D = 12.1$
 $R/D = 1.287$
 $\Delta X = 4.4 \text{ IN.}$

A Amp
A Atten 22
A Gain
B Amp
B Atten 23
B Gain
Date

Run No.
Chan. A
Chan. B
Auto A. or B. B
Cross A. or B. Dcl
Sample Inc. 20
Recomp Del -50
Sums 128
Word Pos 253
Resumes 0
Date APR 13 1976

D-194

$M = 1.5$
 $X/D = 12.1$
 $R/D = 1.287$
 $\Delta X = 8.4 \text{ IN.}$

ORIGINAL PAGE IS
OF POOR QUALITY

A Amp
A Atten **23**
A Gain
B Amp
B Atten **23**
B Gain
Date

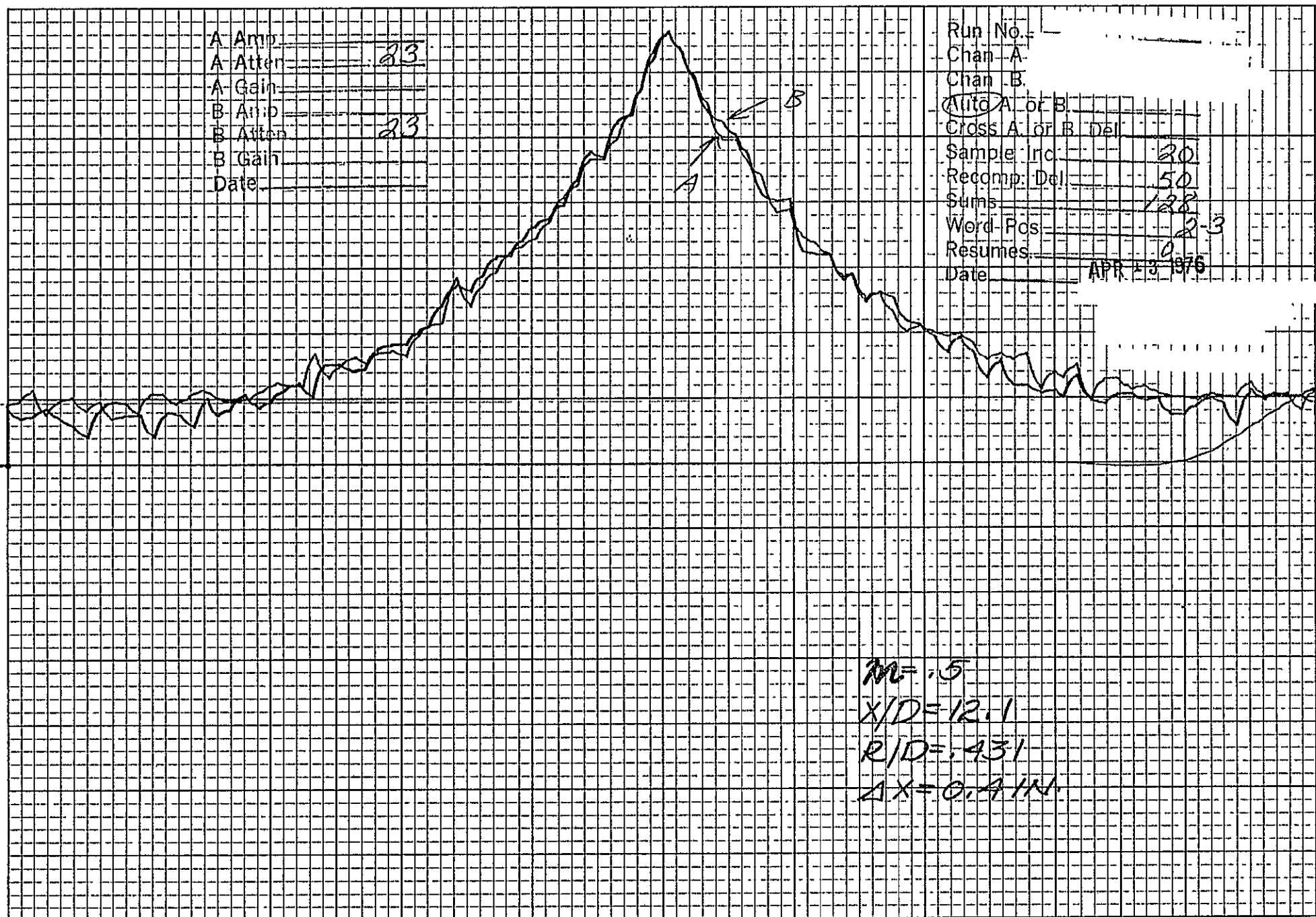
Run No.
Chan. A
Chan. B
Auto. A. or B
Cross. A. or B. Del. **A**
Sample Inc **50**
Recomp. De **0**
Sums **128**
Word Pos **3-3**
Resumes.
Date **APR 1 3 1976**

D-195

$M = .5$
 $X/D = 12.1$
 $R/D = .287$
 $\Delta X = 8.4 \text{ IN.}$

A Amp _____
 A Atten _____ 23
 A Gain _____
 B Amp _____
 B Atten _____ 23
 B Gain _____
 Date _____

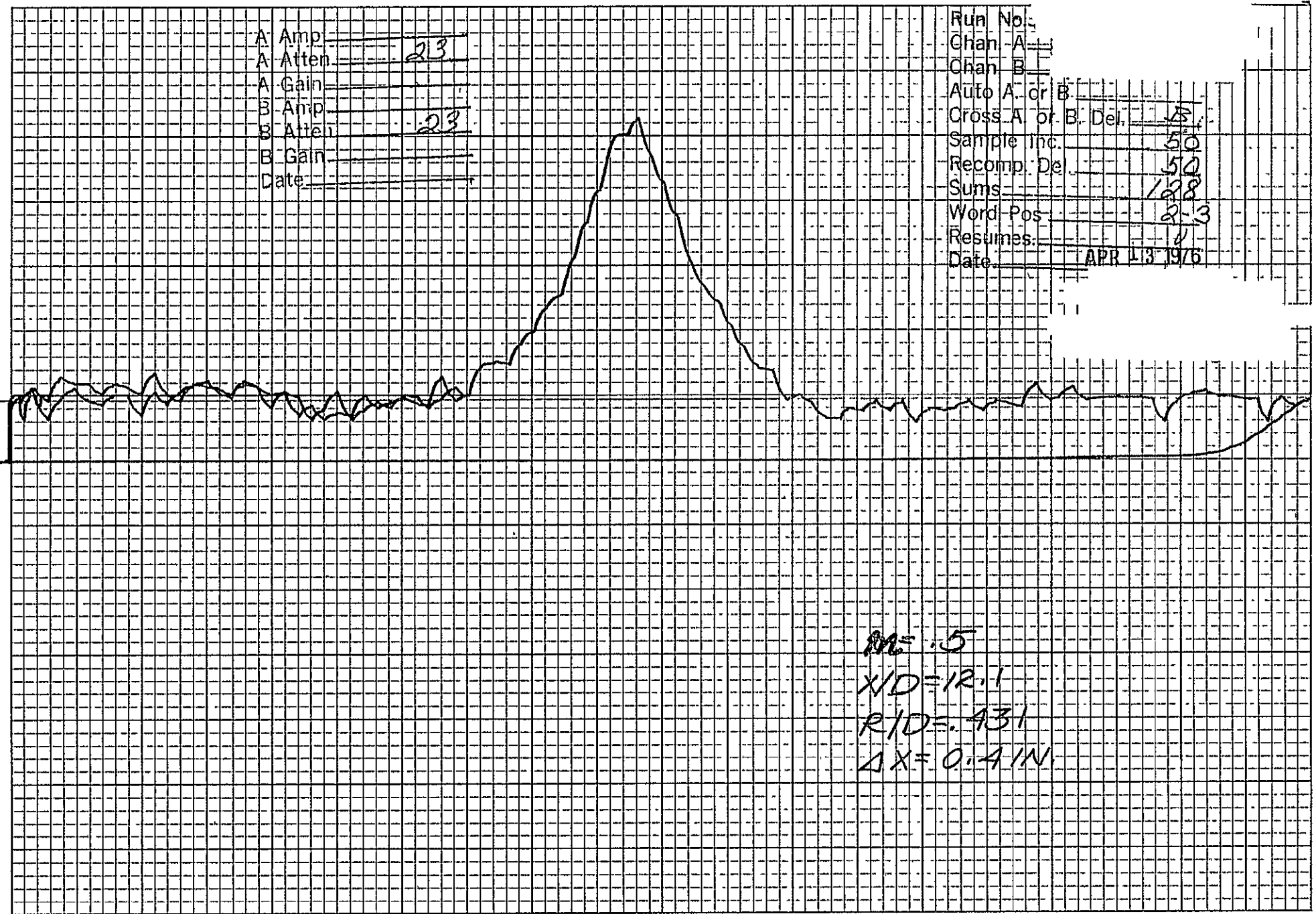
Run No. _____
 Chan. A _____
 Chan. B _____
 Auto A. or B. _____
 Cross A. or B. Del. _____
 Sample Inc. _____ 20
 Recomp. Del. _____ 50
 Sums _____ 128
 Word Pos. _____ 2-3
 Resumes _____ 0
 Date _____ APR 13 1976



D-196

A Amp. _____
 A Atten. 23
 A Gain _____
 B Amp _____
 B Atten. 23
 B Gain _____
 Date _____

Run No. _____
 Chan. A _____
 Chan. B _____
 Auto A or B _____
 Cross A or B Del. 5
 Sample Inc. 50
 Recomp. Del. 50
 Sums 128
 Word Pos. 2-3
 Resumes. 1
 Date APR 13 1976

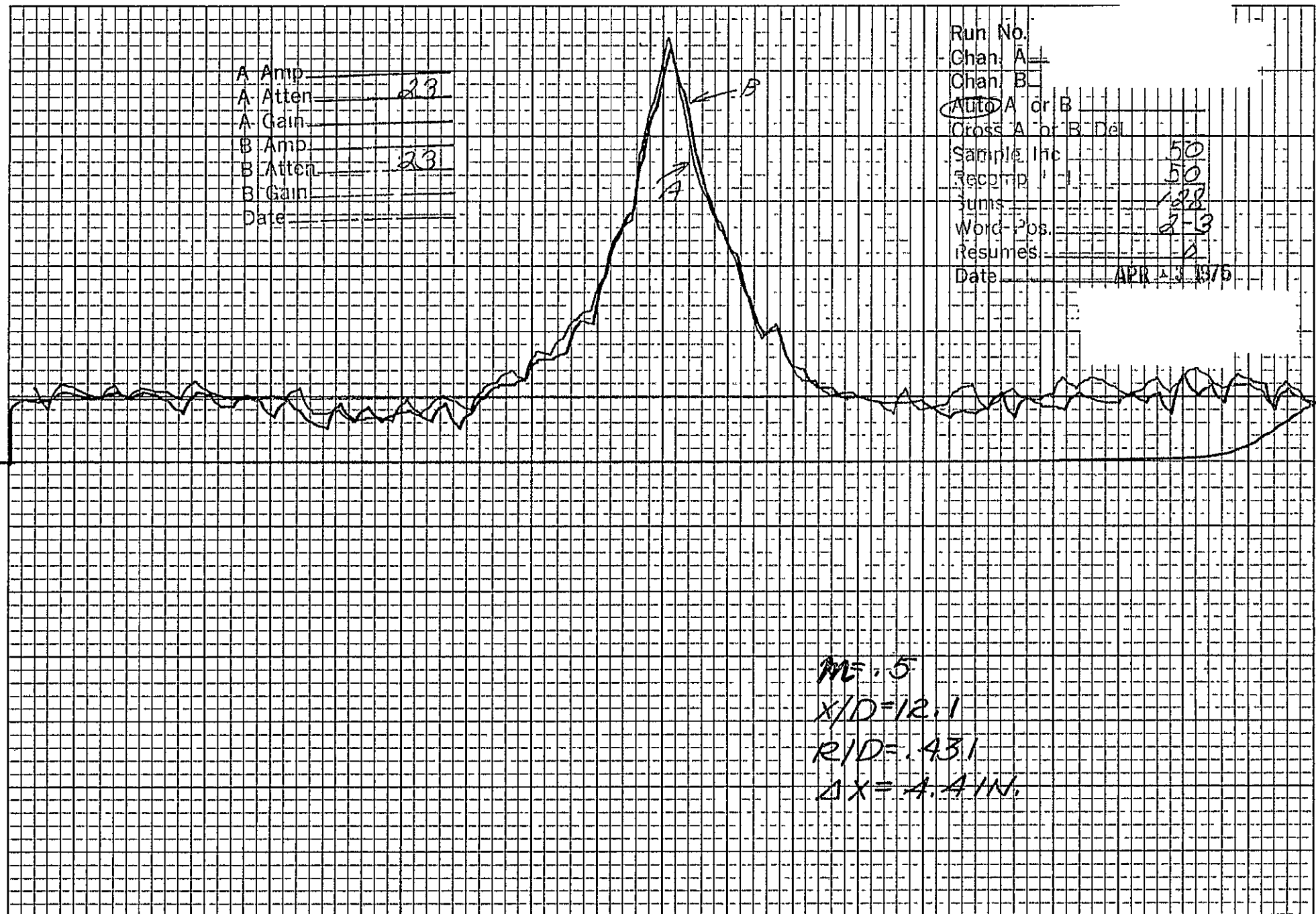


$\mu = .5$
 $X/D = 12.1$
 $R/D = .431$
 $\Delta X = 0.41N$

D-197

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

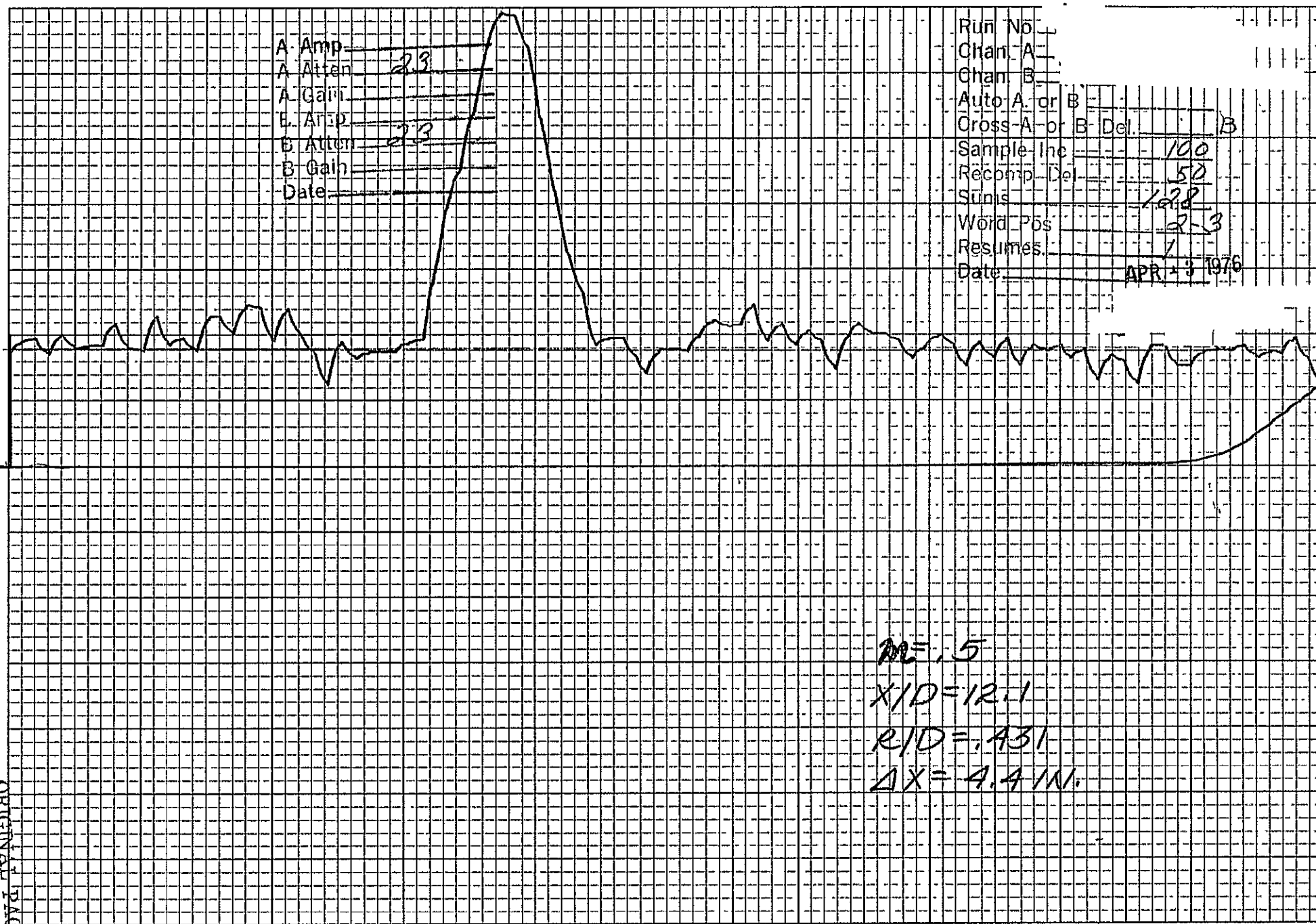
Run No. _____
Chan. A _____
Chan. B _____
AUTO A or B _____
Cross A or B Del _____
Sample Inc 50
Recorp 50
Sumis 128
Word Pos. 2-3
Resumes 1
Date APR 13 1975



$M = .5$
 $X/D = 12.1$
 $R/D = .431$
 $\Delta X = 4.4 \text{ IN.}$

A Amp _____
 A Atten 23
 A Gain _____
 E Atten _____
 B Atten 23
 B Gain _____
 Date _____

Run No _____
 Chan. A _____
 Chan. B _____
 Auto A or B _____
 Cross-A or B Del. B
 Sample Inc 100
 Recomp Del 50
 Sumis 128
 Word Pos 2-3
 Resumes 1
 Date APR 3 1976



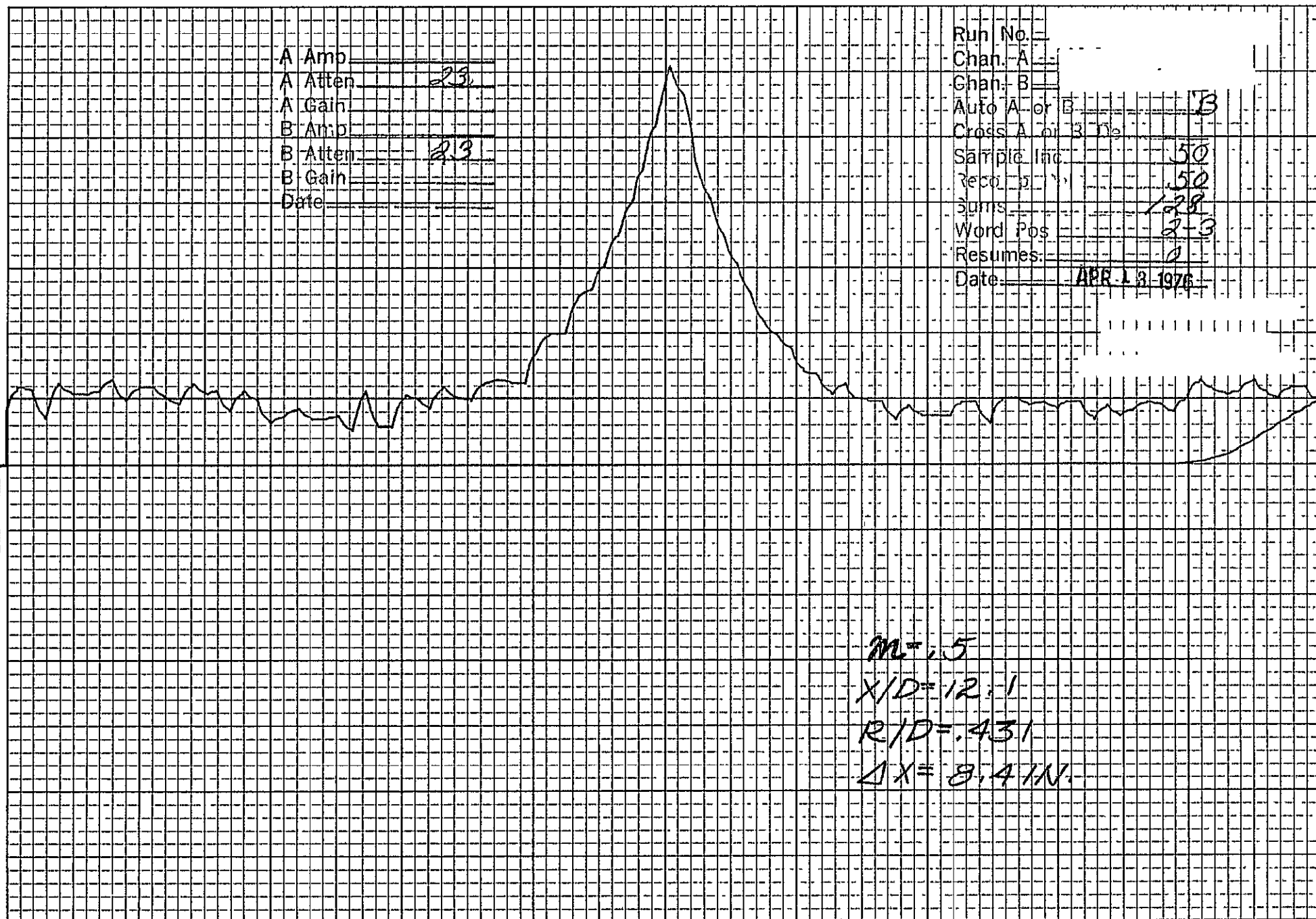
$M = .5$
 $X/D = 12.1$
 $R/D = .431$
 $\Delta X = 4.4 IN.$

D-199

ORIGINAL PAGE IS
 OF POOR QUALITY

A Amp _____
 A Atten. 23
 A Gain _____
 B Amp _____
 B Atten. 23
 B Gain _____
 Date _____

Run No. _____
 Chan. A _____
 Chan. B _____
 Auto A or B B
 Cross A or B No. _____
 Sample Inc. 50
 Reco. 50
 Sums 128
 Word Pos. 2-3
 Resumes. 0
 Date APR 13 1976

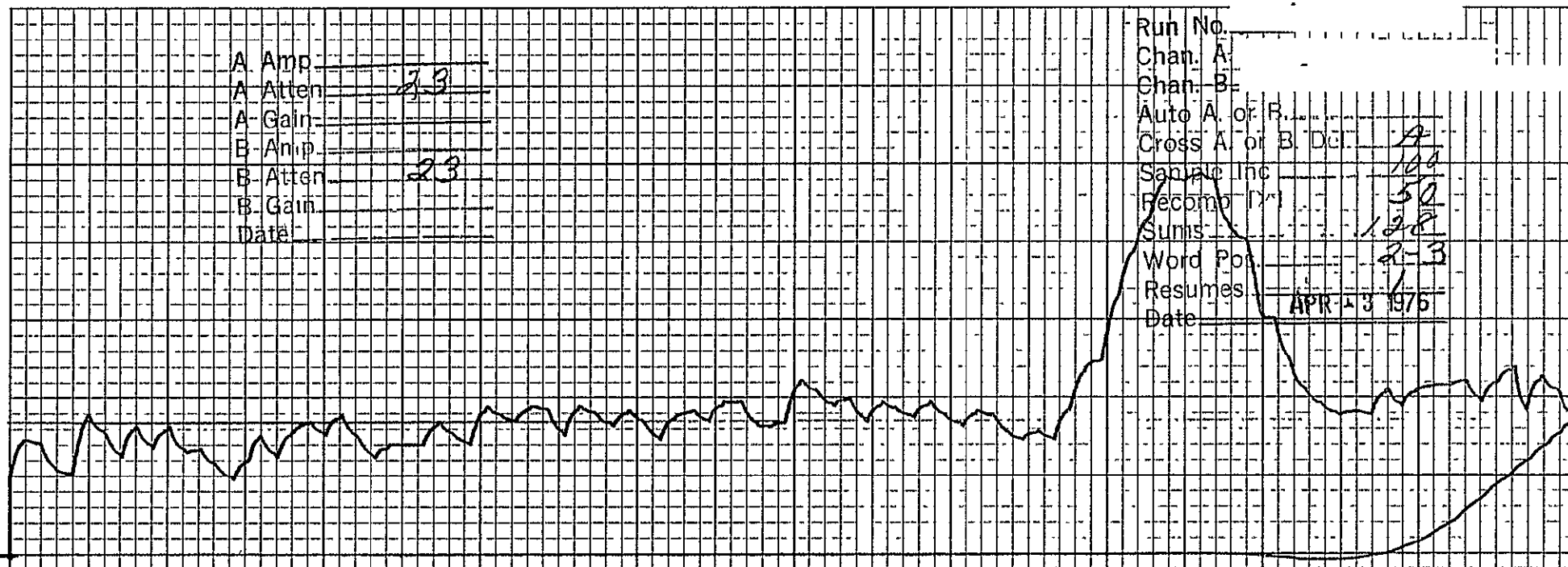


D-200

$m = .5$
 $X/D = 12.1$
 $R/D = .431$
 $\Delta X = 8.41N.$

A Amp _____
A Atten 23
A Gain _____
B Amp _____
B Atten 23
B Gain _____
Date _____

Run No. _____
Chan. A _____
Chan. B _____
Auto A. or B. _____
Cross A. or B. Del. 4
Sample Inc. 100
Recomp. (%) 50
Sumis. 128
Word Pot. 2-3
Resumes. 1
Date APR 13 1975



$m = .5$
 $X/D = 12.1$
 $R/D = .431$
 $\Delta X = 8.4 \text{ IN.}$

D-201

ORIGINAL PAGE IS
OF POOR QUALITY

E. Filtered Auto and Cross Correlations

This section contains the filtered auto and cross correlations. In section D, all the signals were band-pass filtered from 0-20 KHz. In this section the signals were band-pass filtered at the various selected frequency ranges as listed on the bottom center of the plots.

FILTERED AUTO CORRELATION

A Amp _____
A Atten 15
A Gain _____
B Amp _____
B Atten 15
B Gain _____
Date _____

Run No. 1F
Chan. A R=0.0
Chan. B X/D=6.8
(Auto A) or B _____
Cross A or B Del _____
Sample Inc _____
Recomp Del _____
Sums _____
Word Pos _____
Resumes _____
Date APR 9 1976

E-1

F = 100 - 250 Hz
V = 400
TV = 120
ΔX = 3.3

m = 0.3

$\frac{X}{D} = 6.8$ $\frac{R}{D} = 0.496$

ΔX = 3.3 in.

FILTERED FREQUENCY = 100 - 250 Hz

ORIGINAL PAGE IS
OF POOR QUALITY

CROSS
FILTERED ~~A~~ CORRELATION

A Amp. _____
A Atten. 14
A Gain. _____
B Amp. _____
B Atten. 15
B Gain. 11
Date _____

Run No. 1F
Chan. A R=0.0
Chan. B A/D=68
Auto A. or B. _____
Cross A. or B. Del. A
Sample Inc. 100
Recomp. Del. 50
Sums. 128
Word Pos. 2-9
Resumes. 0
Date Apr 9 1978

$F = 100 - 250 \text{ Hz}$
 $V = 400$
 $TV = 120$
 $\Delta x = 3.3$

B-2

$m = 0.3$

$\frac{F}{D} = 6.8$

$\frac{R}{D} = 0.496$

$\Delta x = 5.3 \text{ in}$

FILTERED FREQUENCY = $100 - 250 \text{ Hz}$

FILTERED AUTO CORRELATION

A Amp.
A Atten. 19
A Gain.
B Amp.
B Atten. 20
B Gain.
Date

Run No. 2F
Chan. A R=0.0
Chan. B X/D=6.8
(Auto) A. or B.
Cross A. or B. Del.
Sample Inc. 50
Recomp. Del. 50
Sums 128
Word Pos. 2-2
Resumes.
Date APR 9 1976

F=250-630 Hz
V=400
T=120
 $\Delta x = 3.3$

E-3

m=0.3

$\frac{X}{D} = 6.8$

$\frac{R}{D} = 0.496$

$\Delta x = 3.3$

FILTERED FREQUENCY = 250 - 630 Hz

ORIGINAL PAGE IS
OF POOR QUALITY

FILTERED CROSS CORRELATION

A Amp _____
 A Atten 19
 A Gain _____
 B Amp _____
 B Atten 20
 B Gain _____
 Date _____

Run No. 2F
 Chan. A R=0.0
 Chan. B X/D=6.8
 Auto A cr B _____
 Cross A or B. Del A
 Sample Inc 100
 Recomp. Del 50
 Sums 128
 Word Pos. 2-3
 Resumes 0
 Date _____ APR 9 1976

F = 250-630 Hz

V = 400

TV = 120

AX = 3.3

B4

m = 0.5

X/D = 6.8

AX = 3.3 in

R/D = 0.496

FILTERED FREQUENCY = 250-630 Hz

FILTERED AUTO CORRELATION

A Amp
A Atten 2
A Gain
B Amp
B Atten 22
B Gain
Date

Run No. 3F
Chan. A R=0.0
Chan. B X/D=6.8
Auto A or B
Cross. A or B. Del
Sample Inc. 20
Recomb. Del. 50
Sums 128
Word Pos. 2-3
Resumes
Date APR 9 1976

$F = 630 - 1600 \text{ Hz}$

$V = 400$

$W = 120$

$\Delta X = 3.3$

$m = 0.3$

$\frac{X}{D} = 6.8$

$\frac{R}{D} = 0.496$

$\Delta X = 3.3 \text{ Hz}$

FILTERED FREQUENCY = $630 - 1600 \text{ Hz}$

E-5

ORIGINAL PAGE IS
OF POOR QUALITY

FILTERED CROSS CORRELATION

A Amp.
A Atten. 21
A Gain.
B Amp.
B Atten.
B Gain. 22
Date

Run No. 3F
Chan. A R=0.0
Chan. B X10=6.8
Auto A. or B.
Cross A. or B. Dcl. A
Sample Inc. 50
Recomp Del. 50
Sums 128
Word Pos. 2-4
Resumes. 0
Date APR 9 1975

F = 630-1600 Hz
Y = 400
TV = 120
ΔX = 3.3

$$m = 0.3$$

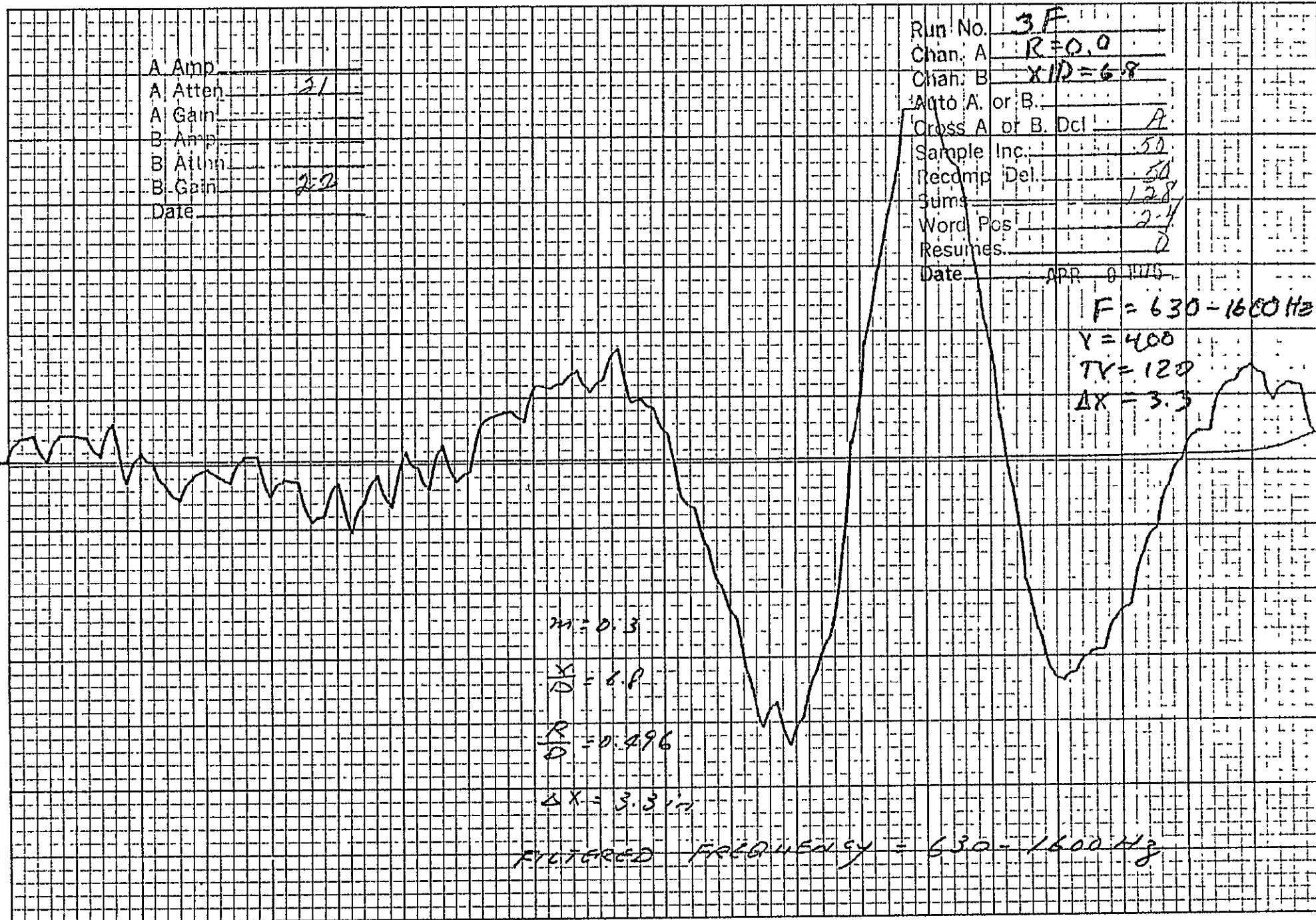
$$\frac{X}{D} = 6.8$$

$$\frac{R}{D} = 0.496$$

$$\Delta X = 3.3 \text{ in.}$$

FILTERED FREQUENCY = 630-1600 Hz

E-6



FILTERED AUTO CORRELATION

A Amp
A Atten 1.9
A Gain
B Amp
B Atten 2.0
B Gain
Date

Run No 4F
Chan. A R=0.8
Chan. B X/D=6.8
Auto A or B
Cross A or B Del
Sample Inc 20
Decomp Del 50
Sums 128
Word Pos 2-3
Resumes 0
Date APR 0 1968

$F = 1.6 - 4 \text{ KHz}$
 $V = 400$
 $TK = 120$
 $\Delta x = 3.3$

E-7

$M = 0.3$
 $\frac{X}{D} = 6.8$
 $\frac{R}{D} = 0.496$
 $\Delta x = 3.3 \text{ in}$

FILTERED FREQUENCY = $1.6 - 4.0 \text{ KHz}$

ORIGINAL PAGE IS
OF POOR QUALITY

FILTERED CROSS CORRELATION

A Amp _____
A Atten 19
A Gain _____
B Amp _____
B Atten 20
B Gain _____
Date _____

Run No. 41F
Chan. A R=10.0
Chan. B X/D=6.8
Auto A. or B. _____
Cross A. or B. Dcl A
Sample Inc 50
Decomp Del 50
Sums 128
Word Pos. 2-4
Resumes 0
Date APR 9 1976

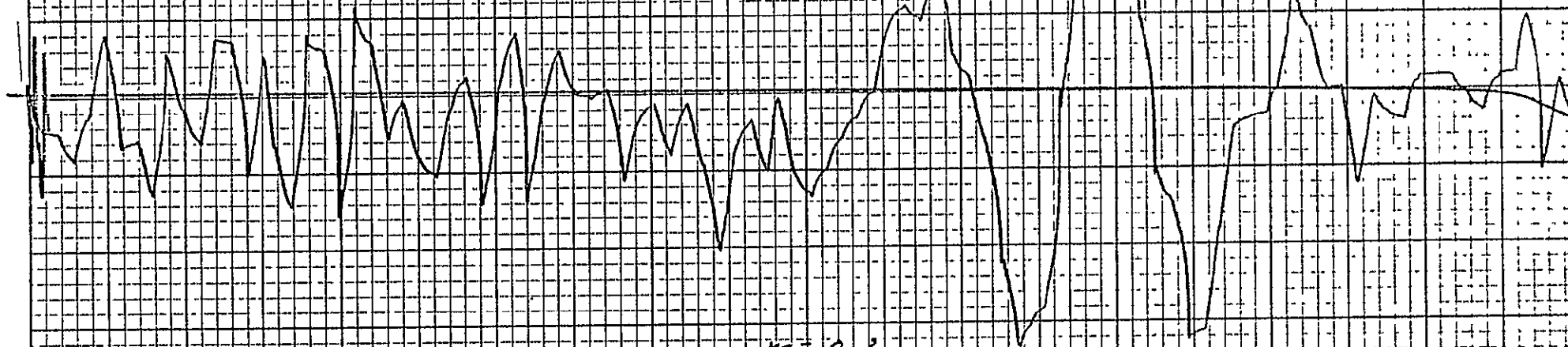
F = 1.6 - 4.0 K HZ
V = 400
TV = 120
 $\Delta X = 3.3$

$M = 0.3$
 $\frac{X}{D} = 6.8$
 $\frac{R}{D} = 0.496$

$\Delta X = 3.3$

FILTERED FREQUENCY = 1.6 - 4.0 KHZ

E-8



F. Normalized Cross Correlation Coefficients

With the following definitions:

A_A = Channel A attenuation for cross correlation

A_B = Channel B attenuation for cross correlation

A_A' = Channel A attenuation for auto correlation

A_B' = Channel B attenuation for auto correlation

R_{AB} = peak cross correlation read from raw data chart

R_{AA} = peak autocorrelation read from raw data chart

R_{BB} = peak autocorrelation read from raw data chart

W_A, W_B, W_{AB} = word position appropriate for autocorrelation A, autocorrelation B, or cross correlation AB

$\gamma_A, \gamma_B, \gamma_{AB}$ = resumes factor appropriate for autocorrelation A, autocorrelation B, or cross correlation AB

The normalized cross correlation coefficient $\hat{R}_{AB}$ is given by

$$\hat{R}_{AB} = \frac{10^{-A_A/10} 10^{-A_B/10} R_{AB} W_{AB} \gamma_{AB}}{\sqrt{10^{-2A_A'/10} R_{AA} W_A \gamma_A 10^{-2A_B'/10} R_{BB} W_B \gamma_B}}$$

The factor γ may be determined from Table F.1.

Table F.1

Relation of γ to Number of Resumes

<u>Resume</u>	<u>γ</u>
0	1
1	$\frac{1}{2}$
2	$\frac{1}{3}$
3	$\frac{1}{4}$

ORIGINAL PAGE IS
OF POOR QUALITY

Resume8

h

 $\frac{1}{5}$

Normalized cross correlation coefficients are plotted for fixed velocity ratio, in axial position X/D, and radial position R/D as a function of probe axial separation.

Sample Calculation

The following calculation was made for the first set of data in Section D; $m = 0$, $X/D = 3$, $R/D = 0.363$, $\Delta X = 0.6$ in. The data are contained on pages D1 (Autocorrelation A), D2 (Autocorrelation B), and D3 (Cross Correlation).

$$A_A = 27$$

$$A_B = 27$$

$$A'_A = 27$$

$$A'_B = 27$$

$$R_{AB} = 27.8$$

$$R_{AA} = 20.0$$

$$R_{BB} = 18.0$$

$$W_A = 2-3$$

$$W_B = 2-3$$

$$W_{AB} = 2-4$$

$$r_A = 1$$

$$r_B = 1$$

$$r_{AB} = 1$$

$$\text{Then } \hat{R}_{AB} = \sqrt{\frac{10^{-2.7} \times 10^{-2.7} \times 27.8 \times 2^{-4} \times 1}{10^{-5.4} \times 20 \times 2^{-3} \times 1 \times 10^{-5.4} \times 18 \times 2^{-3} \times 1}} = 0.73$$

NORMALIZED CROSS CORRELATION COEFFICIENTS

1.0
0.8
0.6
0.4
0.2
0

$\bar{r}_{AB}$

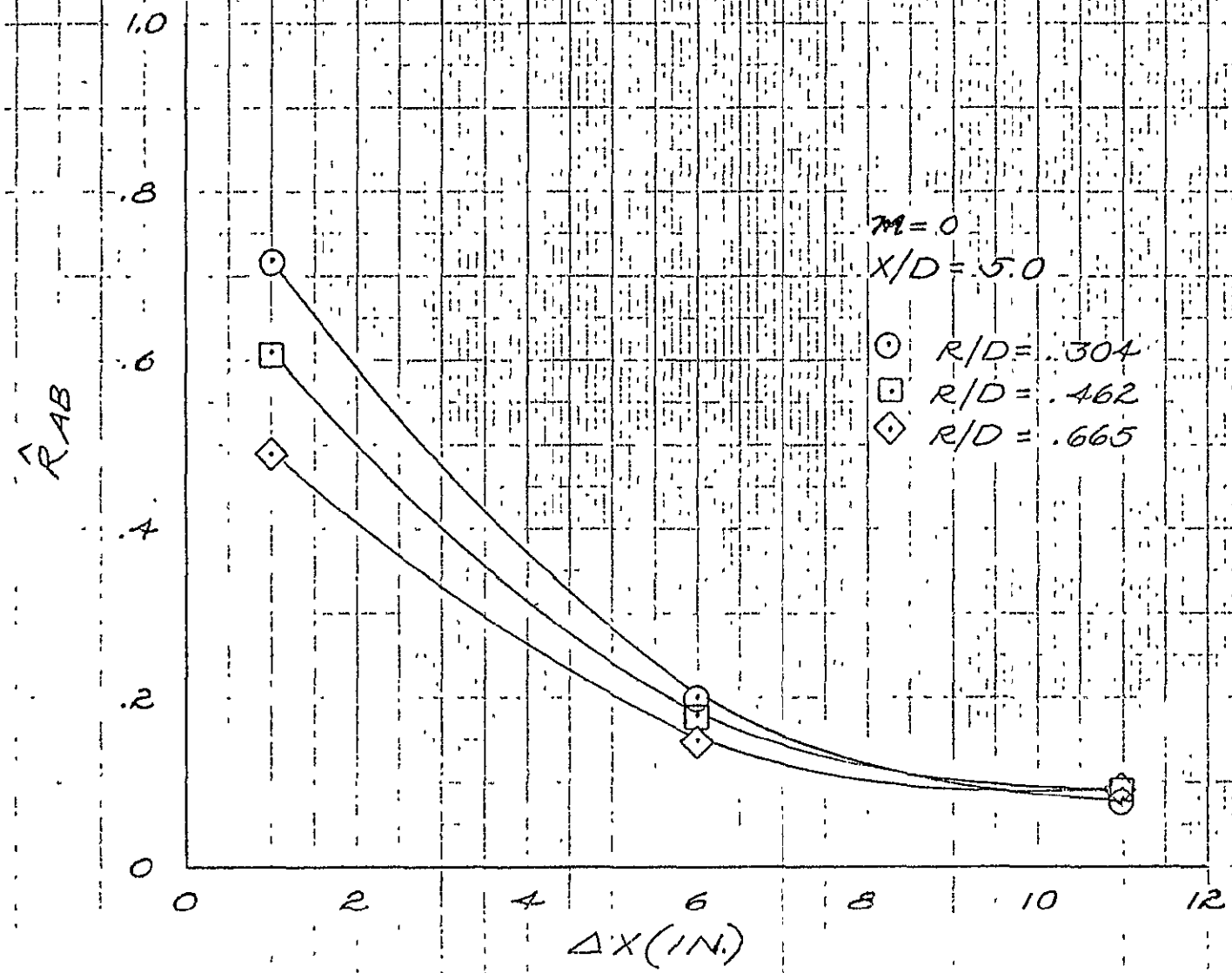
$M=0$
 $X/D=3.0$

○ $R/D = .363$
□ $R/D = .507$
◇ $R/D = .665$

$\Delta X (IN.)$

0 2 4 6 8 10 12

NORMALIZED CROSS CORRELATION COEFFICIENTS

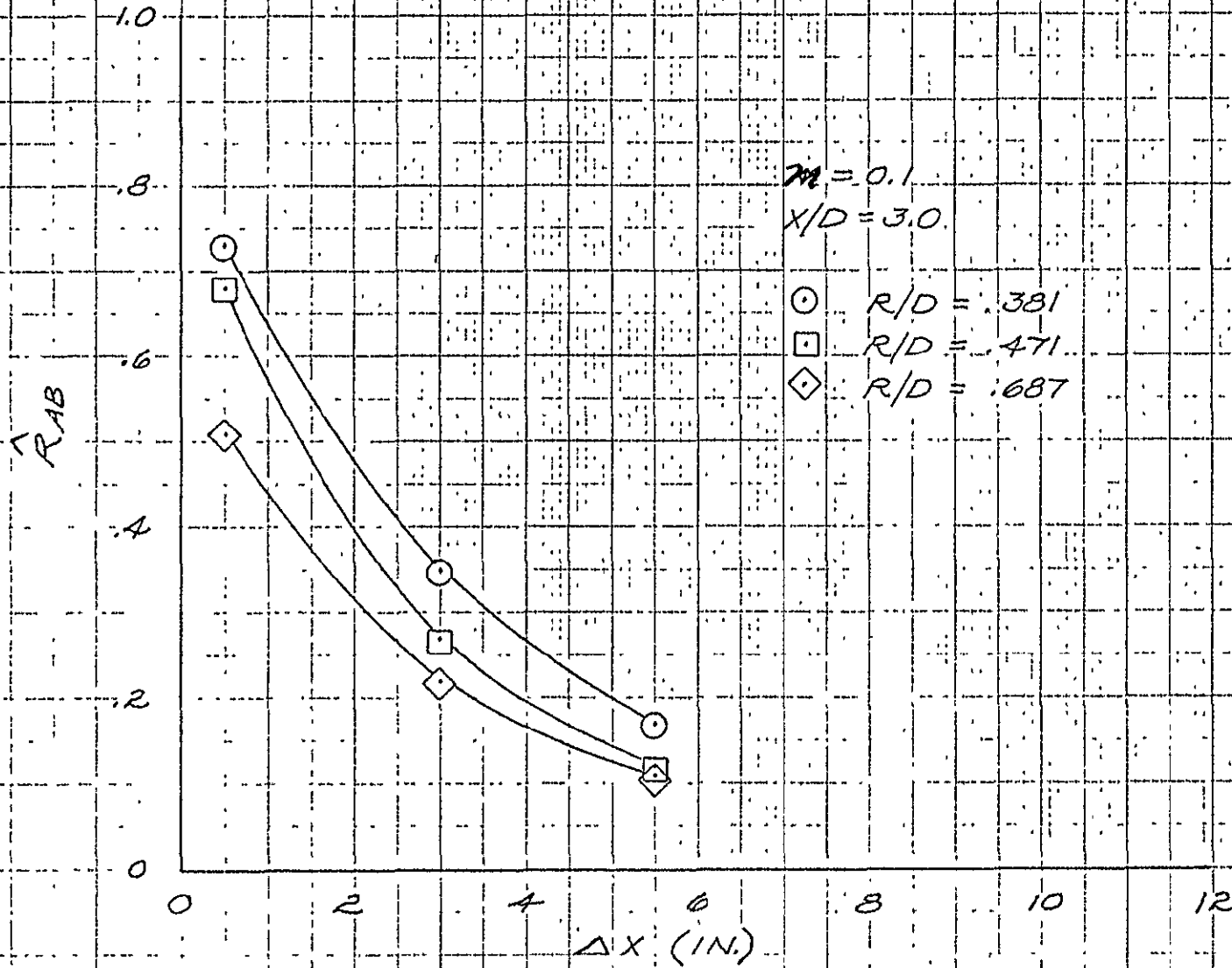


$M=0$

$X/D=5.0$

- $R/D = .304$
- $R/D = .462$
- ◇ $R/D = .665$

NORMALIZED CROSS CORRELATION COEFFICIENTS



$\hat{r}_{AB}$

NORMALIZED CROSS-CORRELATION COEFFICIENTS

1.0

.8

.6

.4

.2

0

0

2

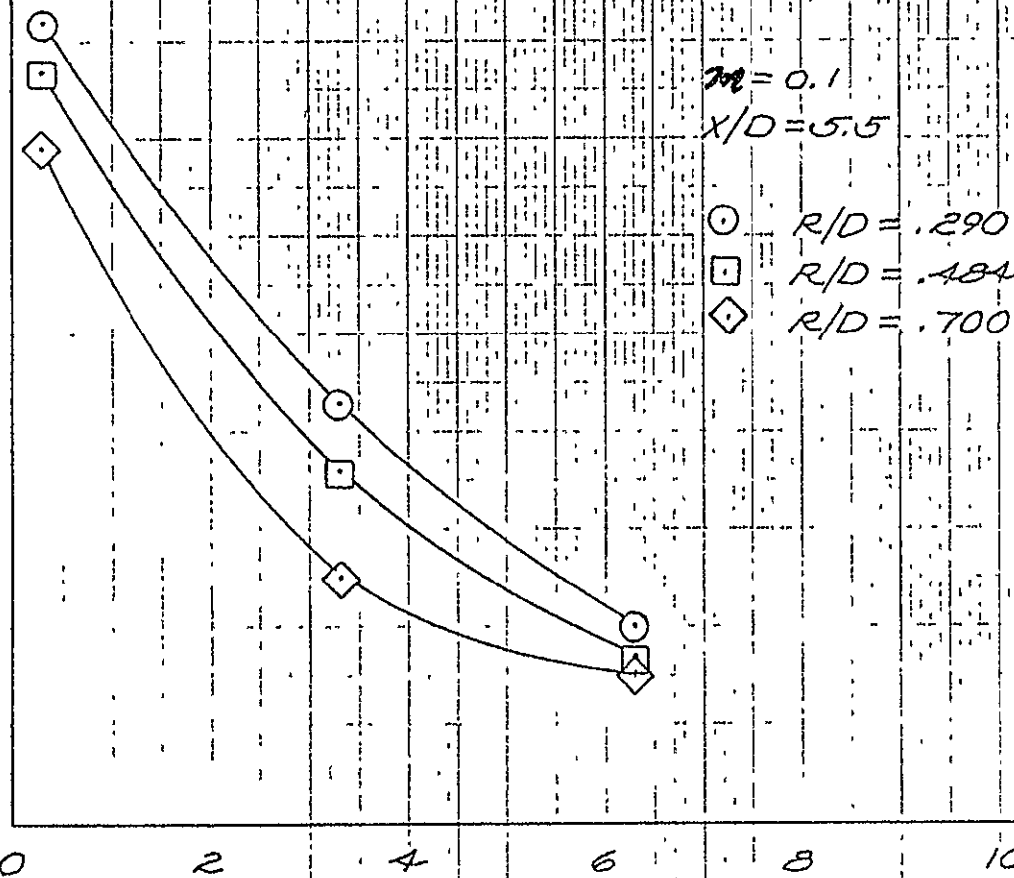
4

6

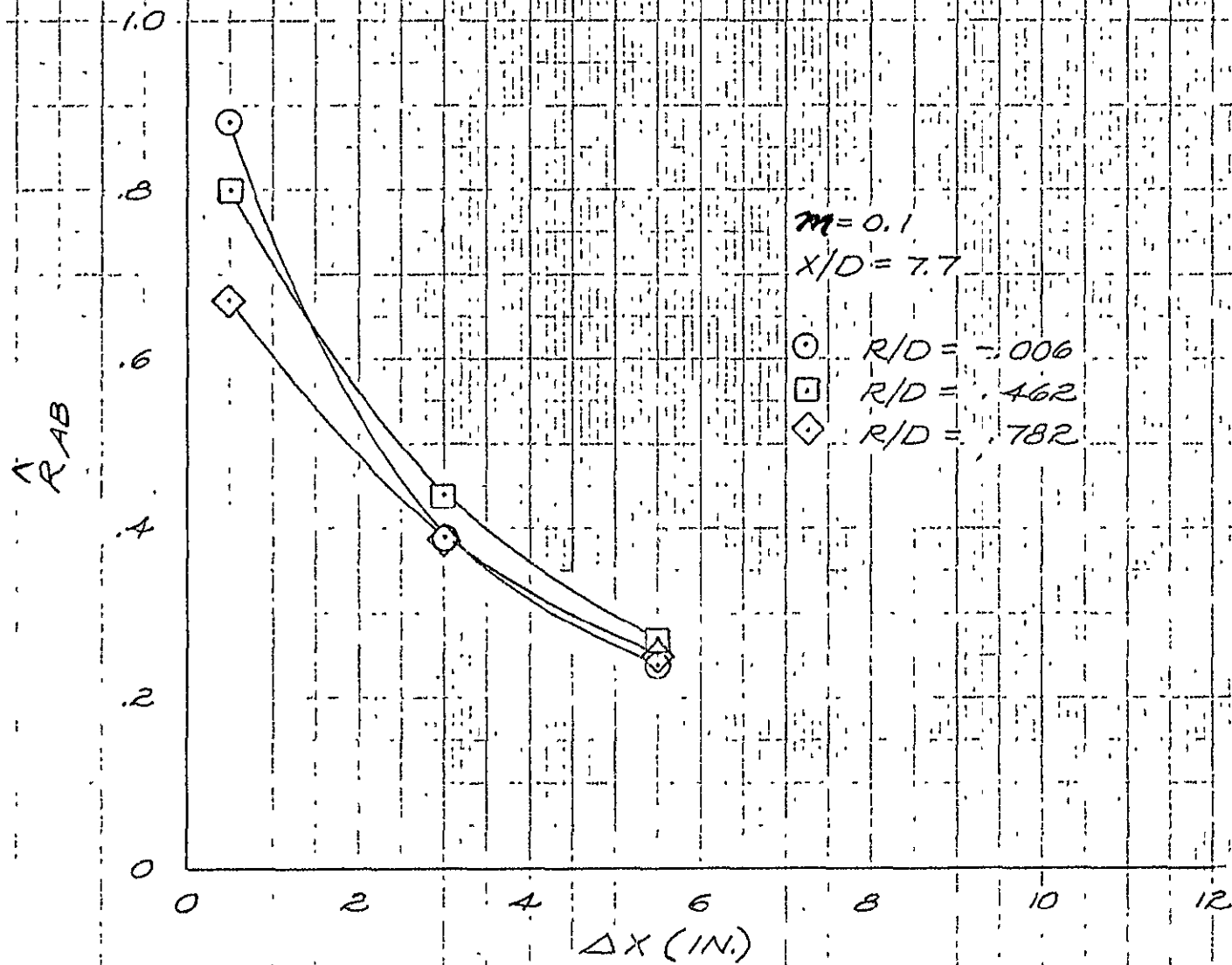
8

10

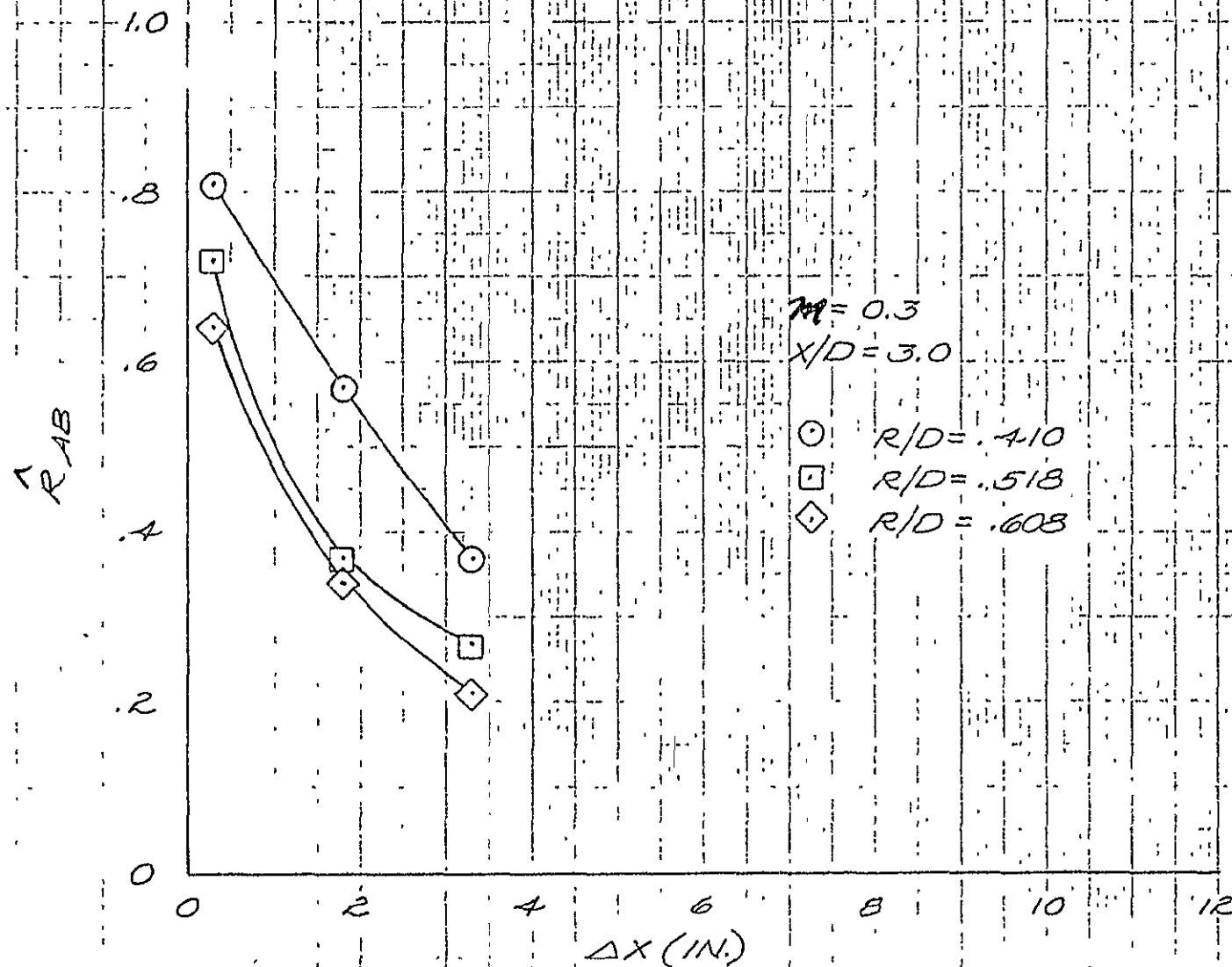
12

 Δx (IN.) $M = 0.1$ $x/D = 5.5$ ○ $R/D = .290$ □ $R/D = .484$ ◇ $R/D = .700$ 

NORMALIZED CROSS CORRELATION COEFFICIENTS



NORMALIZED CROSS CORRELATION COEFFICIENTS



NORMALIZED CROSS CORRELATION COEFFICIENTS

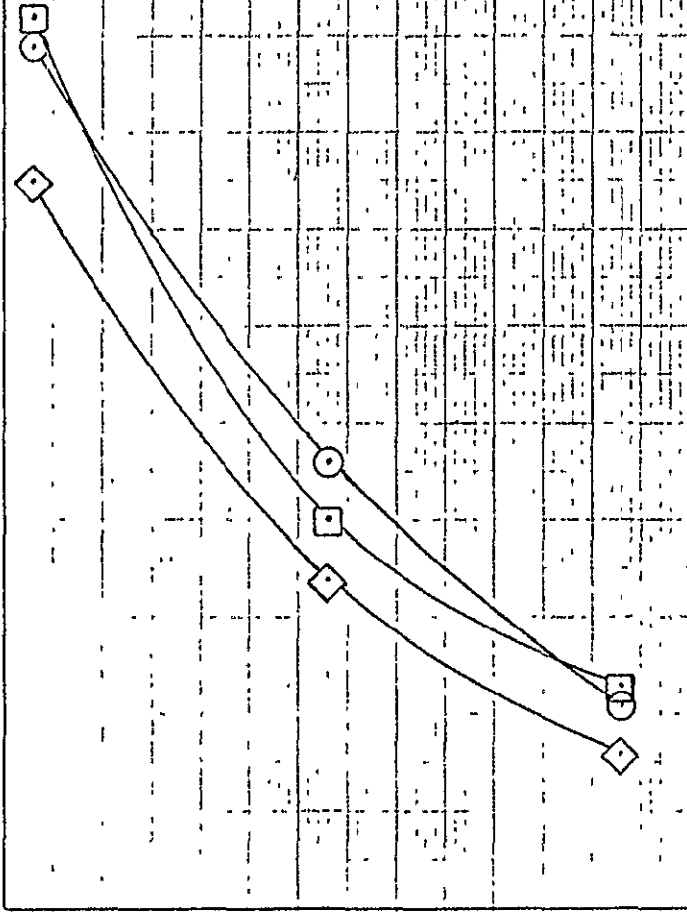
R_{AB}

1.0
.8
.6
.4
.2
0

ΔX (IN.)

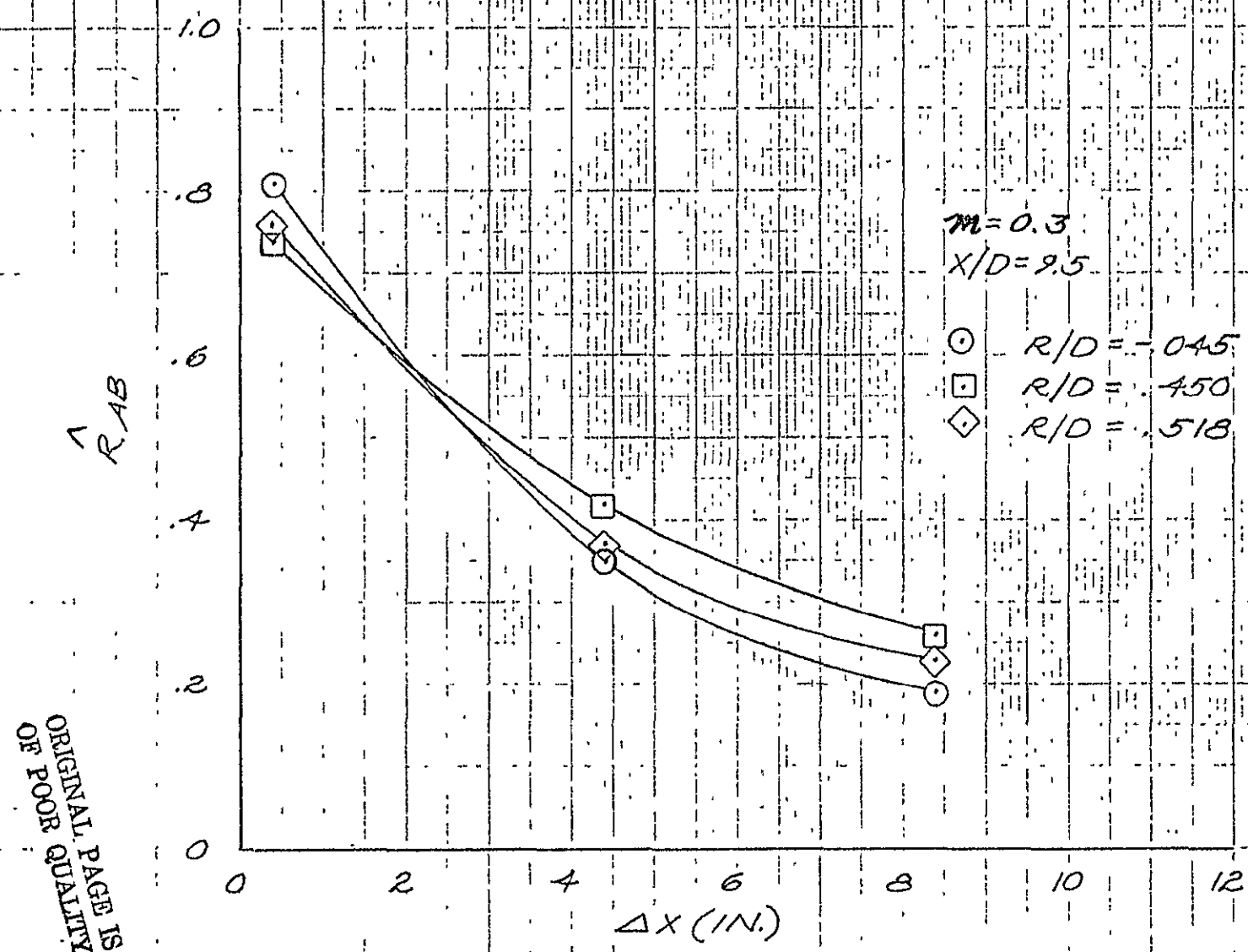
0 2 4 6 8 10 12

$m = 0.3$
 $X/D = 6.8$
 $\circ R/D = .352$
 $\square R/D = .496$
 $\diamond R/D = .658$



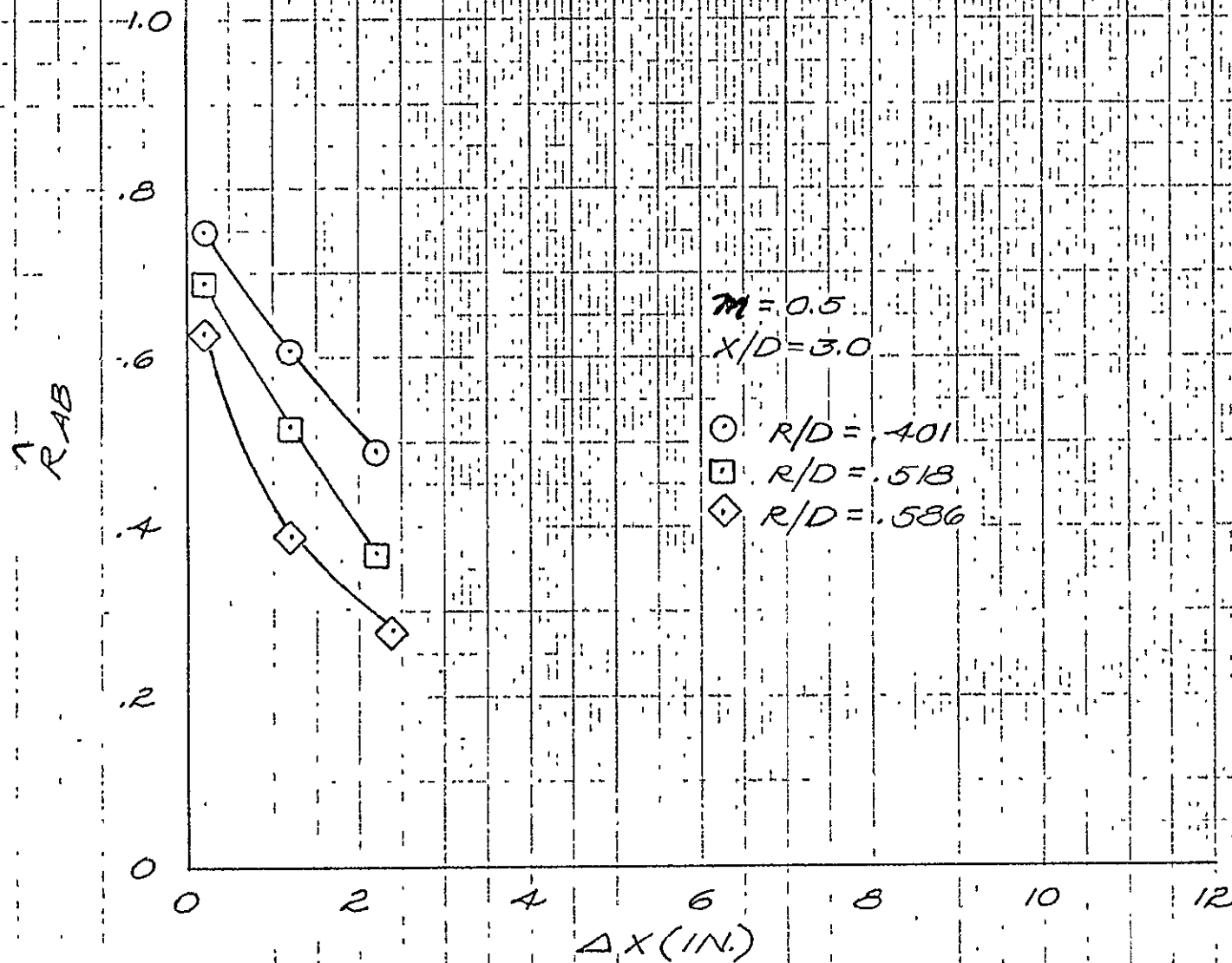
ORIGINAL PAGE IS
OF POOR QUALITY

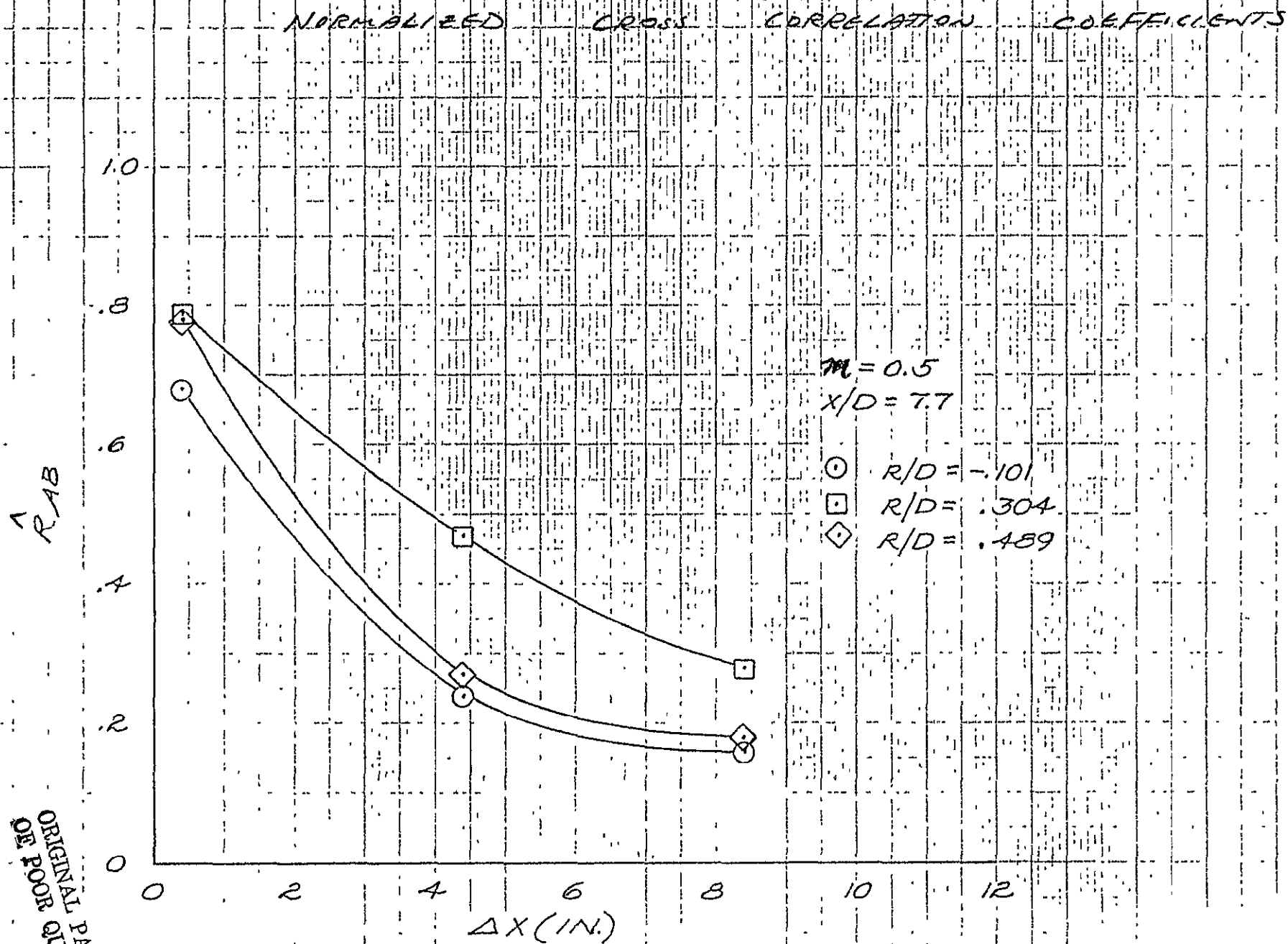
NORMALIZED CROSS CORRELATION COEFFICIENTS



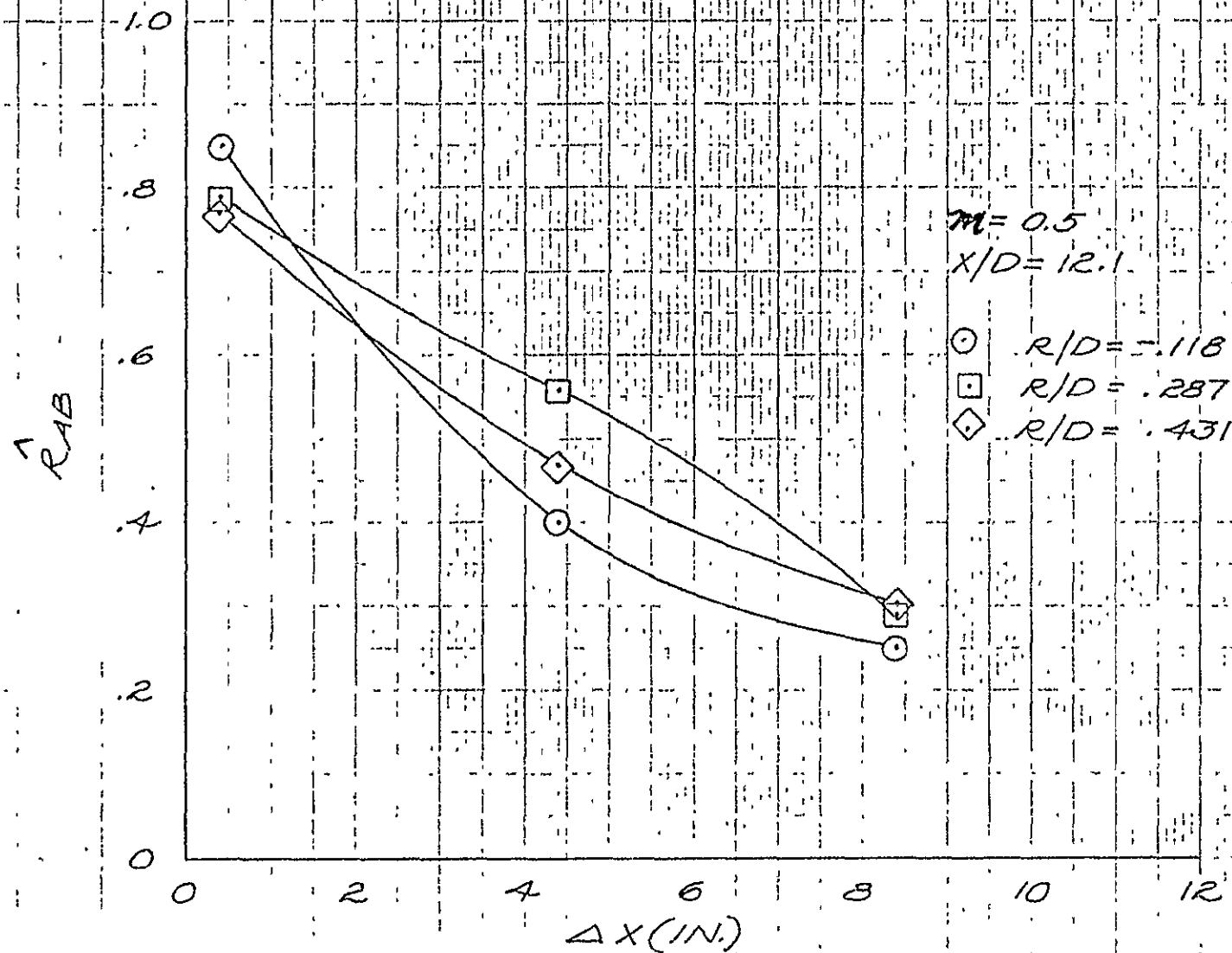
ORIGINAL PAGE IS
 OF POOR QUALITY

NORMALISED CROSS CORRELATION COEFFICIENTS





NORMALIZED CROSS CORRELATION COEFFICIENTS



NORMALIZED CROSS CORRELATION COEFFICIENTS

1.0

0.8

0.6

0.4

0.2

0

$M = 0.3$

$X/D = 6.8$

$R/D = 0.496$

$\Delta x = 3.3 \text{ in.}$

FILTERED FREQUENCY (KHz)

- 0.1 - 0.25
- 0.25 - 0.63
- ◇ 0.63 - 1.60
- △ 1.60 - 4.00

$\Delta x (\text{in.})$

$\uparrow$
RAB

ORIGINAL PAGE IS
OF POOR QUALITY

G. Tabulation of Convection Velocity

The convection velocity is determined by cross correlating the fluctuating signals of two hot wires which are separated axially by a distance ΔX . Convection velocities are calculated by dividing the separation ΔX by the time delay for the maximum cross correlation coefficient. A tabulation of the calculated convected velocities is contained in this section.

CONVECTION VELOCITY

$m = \frac{u_e}{u_j}$	$\frac{x}{D}$	$\frac{R}{D}$	Δx (in)	u_c (fps)	$m = \frac{u_e}{u_j}$	$\frac{x}{D}$	$\frac{R}{D}$	Δx (in)	u_c (fps)
0	3.0	0.363	0.6	200	0.1	3.0	0.381	0.5	278
		0.363	3.0	281			0.381	3.0	278
		0.363	5.4	282			0.381	5.5	296
		0.507	0.6	213			0.471	0.5	189
		0.507	3.0	230			0.471	3.0	263
		0.507	5.4	254			0.471	5.5	270
		0.665	0.6	106			0.687	0.5	194
		0.665	3.0	181			0.687	3.0	199
	✓	0.665	5.4	190		✓	0.687	5.5	202
	5.0	0.304	1.0	278		5.5	0.290	0.3	196
		0.304	6.0	297			0.290	3.3	289
		0.304	11.0	278			0.290	6.3	282
		0.462	1.0	220			0.484	0.3	147
		0.462	6.0	250			0.484	3.3	239
		0.462	11.0	237			0.484	6.3	239
		0.665	1.0	167			0.700	0.3	86
		0.665	6.0	217			0.700	3.3	198
✓	✓	0.665	11.0	207		✓	0.700	6.3	202
						7.7	0.006	0.5	306
							0.006	3.0	301
							0.006	5.5	337
							0.462	0.5	177
							0.462	3.0	238
							0.462	5.5	239
							0.782	0.5	123
							0.782	3.0	160
					✓	✓	0.782	5.5	189

ORIGINAL PAGE IS
OF POOR QUALITY

CONVECTION VELOCITY

$m = \frac{U_c}{U_j}$	$\frac{x}{D}$	$\frac{R}{D}$	Δx (in)	U_c (fps)	$m = \frac{U_c}{U_j}$	$\frac{x}{D}$	$\frac{R}{D}$	Δx (in)	U_c (fps)
0.3	3.0	0.410	0.3	240	0.5	3.0	0.401	0.2	333
		0.410	1.8	319			0.401	1.2	333
		0.410	3.3	299			0.401	2.2	340
		0.518	0.3	216			0.518	0.2	269
		0.518	1.8	259			0.518	1.2	286
		0.518	3.3	263			0.518	2.2	306
		0.608	0.3	174			0.586	0.2	157
		0.608	1.8	246			0.586	1.2	286
	✓	0.608	3.3	246		✓	0.586	2.2	276
	6.8	0.352	0.3	219		7.7	-101	0.4	980
		0.352	3.3	299			-101	4.4	367
		0.352	6.3	309			-101	8.4	375
		0.496	0.3	179			0.304	0.4	292
		0.496	3.3	262			0.304	4.4	324
		0.496	6.3	269			0.304	8.4	328
		0.658	0.3	132			0.489	0.4	256
		0.658	3.3	237			0.489	4.4	302
	✓	0.658	6.3	236		✓	0.489	8.4	295
	9.5	-045	0.4	347		12.1	-118	0.4	483
		-045	4.4	327			-118	4.4	353
		-045	8.4	318			-118	8.4	350
		0.450	0.4	185			0.287	0.4	298
		0.450	4.4	256			0.287	4.4	319
		0.450	8.4	252			0.287	8.4	306
		0.518	0.4	139			0.431	0.4	300
		0.518	4.4	255			0.431	4.4	286
✓	✓	0.518	8.4	238	✓	✓	0.431	8.4	269

CONVECTION VELOCITY

$$\frac{R}{D} = 0.496$$

$m = \frac{U_e}{U_j}$	$\frac{x}{D}$	Δx (in)	FILTERED FREQUENCY (KHz)		U_c (fps)
0.3	6.8	3.3	.1 -	.25	217
			.25 -	.63	250
			.63 -	1.60	275
Y	Y	Y	1.60 -	4.00	285

ORIGINAL PAGE IS
OF POOR QUALITY